PRODUCTS finishing

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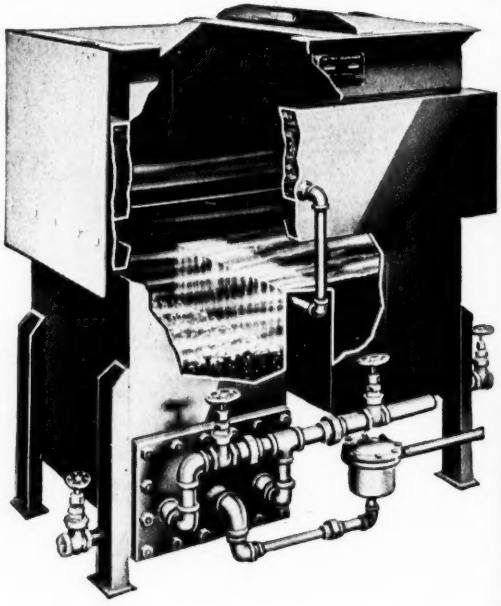

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PRODUCTS finishing

CINCINNATI, OHIO VOL. I No. 2

NOVEMBER, 1936

The Growing Importance of Metal Finish

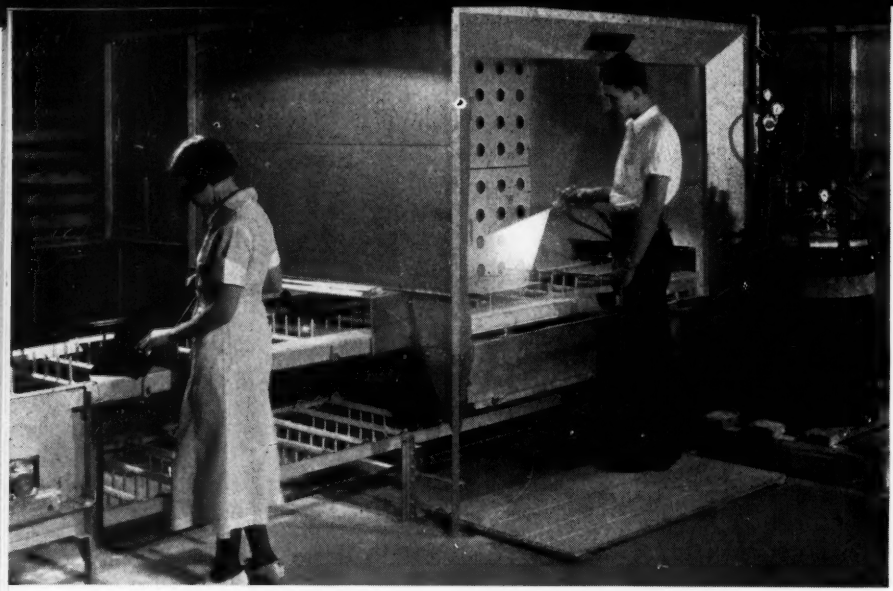
BY HERBERT R. SIMONDS

Vice-Pres., Metal Products Exhibits, Inc., Rockefeller Center, New York

STYLE and buying trends are constantly changing in the realm of metal products, just as they are in the more obvious realm of Paris hats. And whether it be a hat or a hoe, the color and finish are important selling features. In the case of the hoe, as in that of nearly every metal product, the question of finish has jumped into prominence during recent years, not only from the point of view of sales but from that of manufacturing as well.

In one sense, today may be termed an age of metal finishing, for the emphasis in the metal industries has swung from inner to outer characteristics and from fabricating processes to surface treatment. Thus if we trace the development of manufacturing over a period of 75 or 100 years we find at first small production, with the foundry prominent, then through many years we see the growth of mass production methods, with accent on the machine shop, and now, with the urgent market fairly well supplied, the trend is toward mass distribution which calls for greater consumer appeal and focuses manufacturing attention on the finishing department.

Of course the broad term "metal finish" has to do with many aspects of the industry other than appearance. Protection of surface probably accounts for more actual manufacturing dollars than does aesthetic appeal. Galvanizing, for instance, is associated largely with protection, and government statistics show that more than 1,000,000 tons of iron and steel products are galvanized each year. Besides surface protection there is the growing use of a finish to protect contents of vessels. The importance of the humble tin can in our lives testifies to this use. And at this very moment we are witnessing a dramatic struggle between metal and glass for the retail beer package, and an equally dramatic and strenuous struggle between metal and wood for the wholesale container—the beer keg. In both cases, surface finish furnishes the



A modern spray booth. The work passes through the booth on a power conveyor. *(Photo Courtesy Binks Mfg. Co.)*

heavy artillery for the metal forces.

Knowledge of Available Finishes

An up-to-the-minute knowledge of metal finishing processes is important to nearly everyone actively engaged in the metal working industry. The shop superintendent, the sales manager, the independent plating shop owner, all stand to lose cold cash by sleeping at the metal finishing switch. New kinds of finishes are being developed and new finishing equipment constantly is appearing to alter costs and manufacturing practice, and because of such changes the manufacturer of a metal product must keep abreast of progress. He should know, for instance, that a newly developed electrogalvanizing process makes it possible to achieve heavier zinc coatings, that black nickel plating now is practicable, and that barrels are being successfully used for chromium plating of small parts.

Often the value of a new process such as this last item is not at first apparent. The manufacturer may say: "Very good, that will reduce the cost of chromium plating, but the cost even at present is not a determining factor when we want just the effect that is to be secured with chromium." Here one point is missed entirely, for the basic structural design of a product may be affected by a change in finishing technique. This is particularly true in the case of chromium plating where the throw of the metal is relatively poor and where the location of anodes must be considered.

Another kind of progress, with potential significance for the metal worker, has to do with available raw materials. Thus the arrival of prelacquered sheets which would stand deep drawing changed many plans for product fabrication.

The various finishing operations, although in themselves widely separated and even competitive, are in another sense interdependent and complementary. Some special types of reflectors, for instance, combine rustproofing, polishing, plating, and lacquering. And because of this interdependence of processes it is important for those engaged in one field to be thoroughly familiar with developments in another field. This is particularly true of those engaged in

plating and in lacquering, for progress in either field may outmode or, on the other hand, may enhance current practice in the other.

Finishing Characteristics

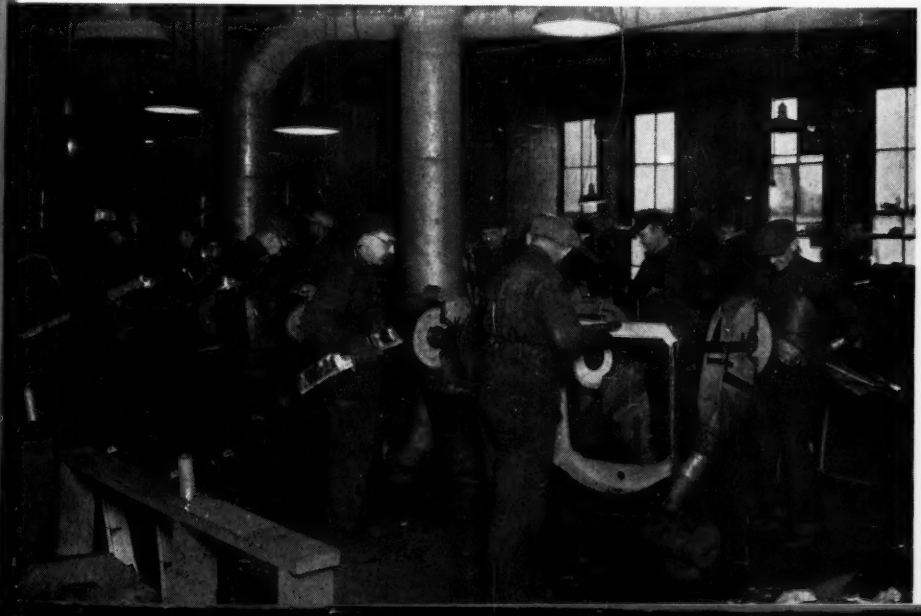
Nearly all metal finishing comes under three broad classifications.

1. Base Metal. Under this heading fall all cases where the base metal itself gives the final surface effect. Examples are the selection of bronze castings for architectural work, of rustless steels for automobile trim, and of nickel silver for instruments. The manufacturer wishing a certain effect in the finish of a product may get this effect by using the proper base material without any applied finish. He has a great variety of alloys to choose from, and with a little ingenuity he may get almost any desired color effect. He may also vary the surface characteristics by varying polishing technique. Many handicaps of course interfere with the use of the base metal as a means of securing finish. Usually the properties such as strength, low cost, and easy fabrication do not harmonize with specified appearance and resistance to corrosion. To promote such harmony, plating and organic coating have been developed.

2. Plating. One of the earliest means of giving a metal product a more attractive and more enduring surface was plating, and this is probably still the most important finishing process, if the entire metal working industry is considered. Tin plate alone now amounts to nearly 2,000,000 tons yearly in the United States. The technique of plating in many cases is relatively simple, but it usually requires fairly expensive preparation of the surface to be plated, and many of the possibilities in the way of denser plates and more uniform thickness still remain to be developed.

3. Coating. There seems to be no well accepted term covering the application of paints, enamels, and lacquers to metal, but if they are grouped together under the term "coating" they form a very important division of the metal finishing art, and one of

Polishing room in an automobile radiator factory.
(Photo Courtesy U. S. Elec. Tool Co.)



the significant features is that research work in this particular field has been aggressive recently, with the result that most other finishing processes are threatened. Lacquers in nearly all colors and in novelty effects are now available for coating metal, and many of the new synthetic lacquers are sufficiently elastic and adherent to permit considerable drawing and forming of the metal after they have been applied. This means economy not only in finishing but in other manufacturing operations as well.

Some exceptions to the above three classifications should be noted. Cladding, which is a method of bonding two different metals together so as to secure the strength and economy of one combined with the surface effect of the other, is used at present chiefly in the form of nickel-clad steel for handling acids, or in other places where the protective value of a more expensive metal is desired. Another exception is the chemical treatment of the base metal to produce a salt of that metal on the surface and thus create new surface properties. Examples of this are the artificial patina on copper and the surface phosphates and chromates on steel.

Metal spray-coating is another process which does not seem to fit either under plating or coating, as described above. By melting a wire of most any of the usual metals such as aluminum, nickel, and stainless steel, and then spraying the molten particles by air blast on to a metal surface, it is possible to coat the metal surface with the sprayed material in such a way as to protect it for many purposes or to give it a new appearance. A metal coating produced in this way is much more porous than in the case of the usual plating process, and the bond between the sprayed coat and the base metal is nowhere near as firm. Nevertheless, technique of spraying is developing rapidly and it is a finishing process which must be seriously considered.

There are several other coating processes which, strictly speaking, are exceptions to the above three classifications. One of these is sherardizing, where powdered zinc is brought into contact with the parts to be coated, at a temperature below the melting point of zinc. Usually this is done in a barrel where the bond between the powder and the metal is created mechanically.

Polishing

Polishing and buffing, although mentioned here under base metal finish, nevertheless occupy an important place in nearly all finishing of metal products. If the part is to be plated it must first be polished. If it is a rolled shape to be enameled, it must nearly always have a smooth surface which calls for grinding of the roll which produces it. In fact it is only due to the perfection in the grinding and polishing of sheet rolls that industry has been able to get the fine-finish automobile sheets which make possible the familiar high-gloss lacquered surfaces demanded on the modern automobile.

In the case of chromium plating, the fine gloss is actually achieved before the chromium is deposited, by polishing the undercoat. Many different effects in the finish of metal products may be secured chiefly by varying the polishing procedure. Mirror finishes are secured through a somewhat complicated technique employing buffs and fine abrasives of the rouge class, but by varying seemingly minor details such as the direction of rotation of the buff, a different color or a different effect may be secured. For preparing a surface for enamel, many manufacturers use a polishing wheel designed to slightly roughen the surface so as to create a better bond between the enamel and the metal.

The metal finisher who wants to secure a matte or non-glass finish may have difficulty indicating his desires, for, unfortunately, there is no standard method of specifying the type of polished surface. Rather common practice is to base the degree of finish on the size of grain used on the abrasive wheel. Thus an order may call for a surface polished with a 120-grain wheel, or if a higher finish is wanted it may specify a 220-grain wheel. A more accurate way is to give the depth of the deepest scratches permissible in the surface.

The cost of polishing small products on a production basis has been reduced notably during the past few years by the introduction of automatic equipment. Thus thimbles are now polished after plating, on completely automatic polishing machines. It is interesting to note here that in one case a thimble manufacture is now preparing thimbles for the plating process by burnishing in burnishing barrels. For many irregular products, burnishing may be a less expensive method of polishing than the use of a polishing wheel.

Spray-Lacquering Refrigerator Panels
(Photo Courtesy Binks Mfg. Co.)

Value of Finish

One of the most important features sought in any finish is its sales value. If that is high enough, the cost of the finish itself is relatively unimportant. In order to determine sales value of different finishes, many manufacturers have carried on extensive research, even going so far as to make up trial lots in different finishes and testing them out on the public. However, even if such a test is made in one locality, it may not be conclusive for the nation as a whole. The public seems to be more susceptible to bright colors in some localities than in others, and the same difference in local taste is apparent with respect to polish and matte finish. Generally speaking, a person will pick up an article with bright clean contrasting colors in preference to one with a simple color or with colors without much contrast. Of course there are many exceptions and in the last analysis the nature of the article itself determines its color. However, designers and sales engineers are continually being surprised by public whims and consequently there is no cut and dried rule.

A manufacturer of hack saw blades distributing largely through retail hardware stores went to the expense of giving his blades a gold or gilt finish, for tests showed that when a package of gilt blades was displayed alongside a package of dull gray

blades the gilt blades would be picked up and examined and bought more frequently than the gray blades.

A common human trait which should be recognized by the man who specifies a metal finish is a weakness for something new or different and thus when the function of a product is well taken care of by its mechanical design, the easiest and often the most effective way of introducing novelty or change is to give it a new type of finish. When the chief motive in changing the finish is a desire for something different, it is usual to select a new finish as far removed from the previous one as possible. For instance, a bright polished chromium finish may be replaced by a black nickel plate, as is being done by Raymond Loewy today in metal furniture design. A dull black product may be altered by giving it a bright colored finish, and a finish which is already colored may be changed to a contrasting color or to a bright nickel. It was purely a desire for change that caused a loose-leaf notebook manufacturer to substitute a colored lacquer for the previously bright nickel finish of the metal ring support, but increased sales resulted.

Economy of Finish

Because of the numerous interlocking operations associated with nearly any finish, something of the total manufacturing sequence should be known if overall economy is to be considered. A manufacturer of a small metal product which costs about 7 cents to produce was anxious to place it in a five-and-ten-cent chain to sell at 10 cents and this necessitated a reduction in the manufacturing cost. He asked his designer if a cheaper finish could be used. This directed study to the problem of finish, and to the surprise of all concerned a less expensive method was discovered which produced a finish conceded to be more attractive than the original more expensive one.

Another case of unexpected economy developed at an adding machine manufacturing plant. Here, in order to get away from more conventional finishes a specialty crackle finish was tried out not only was this effective as a finish but its use meant economy in preceding operations, for it was found that the crackle feature would cover up minor defects in castings.

This latter example well illustrates the association of finish with other operations. With certain crackle finishes it is possible to effect economies clear back to molding procedure in the foundry. Thus, with it, less expensive molding sand may be used because the resultant additional roughness and added sand inclusions may be entirely concealed in finishing.

USS STAINLESS AND HEAT-RESISTING STEELS FOR THE PROCESS INDUSTRIES. An authoritative and complete presentation of the application of stainless steels in the process industries is contained in a new brochure recently issued by subsidiary companies of United States Steel Corporation, P. O. Box 176, Pittsburgh, Pa., under the title "USS Stainless and Heat-Resisting Steel for the Process Industries."

Contained in the 20 pages of this book are discussions of the general classifications of stainless steels, the metallurgy of stainless steels, analysis of the various types of stainless products produced under the "USS" insignia, including the well-known "USS 18-8", an interesting section on the specific uses of these corrosion resistant metals in the chemical process industries, and clearly presented details on fabrication.

Included in the book are two tables of special value. One is a complete analysis of the nominal properties of the USS Stainless steels as compiled by the Corporation's Research Laboratory. This covers seven grades of stainless steel and gives details for each on physical and mechanical properties. The other tabulation is also of primary importance, giving, in full detail, test results showing resistance of USS Stainless steels in three grades to more than two hundred acids and chemicals.

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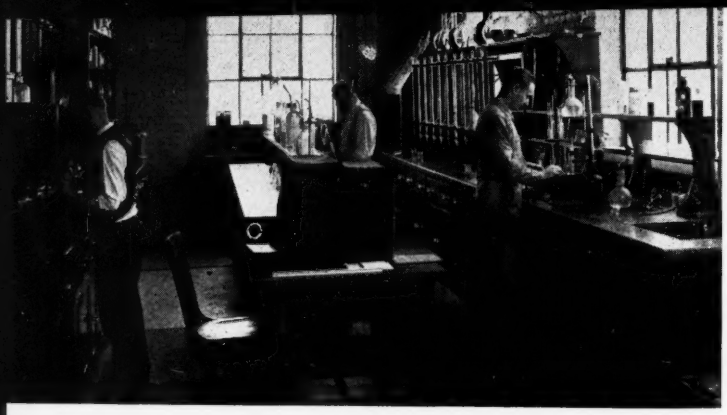

Fig. 1—View of chemical laboratory at Jackson, Mich., plant of Eaton Manufacturing Company.

Finishing Automobile Bumpers in Modern Plant

Eaton Manufacturing Company Equipped To Keep Step with Requirements of Automobile Industry

By C. L. Halladay

IT IS estimated that the output of automobiles for 1936 will be approximately 3,750,000 cars. That is a lot of cars, but it is just twice as many bumpers and that plant that can produce bumpers good enough and economically enough to travel along with the automobile builders—the most efficient manufacturers in the world—must be a very good plant indeed.

The actual manufacture of the bumper is a simple matter compared to the finishing, the finishing operations comprising the major part of the effort expended in the production of the finished piece. Inasmuch as the quality of the work produced is dependent upon the formulas and technique developed and controlled by the laboratories, the entire finishing department is supervised by the chief chemist. A view of the laboratory proper is shown in Fig. 1.

Bumpers are forged from high car-

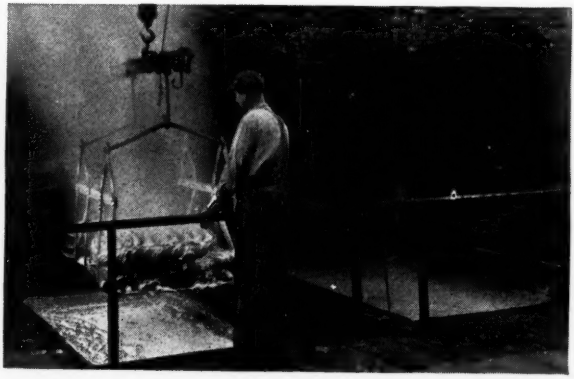

Fig. 2—Scale on the bumper forgings is dissolved in these pickle vats.

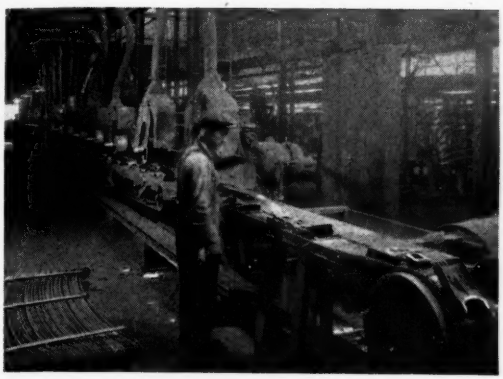

Fig. 3—The bumpers are rough polished in this automatic polishing machine.

bon steel while hot. Thus as the bumper is fabricated, the surface oxidizes and scale forms which must be removed before the polishing and plating operations can be performed. The pickling vat in which the bumpers are placed while the hot acids dissolve the scale is shown in Fig. 2. The "pickle" is the usual solution of muriatic and sulphuric acids in combination. The rack upon which the bumpers are carried into and out of the pickle and rinse vats is made of Monel metal, which is impervious to the action of these acids.

The rinse vat is shown at the right in the illustration, and behind each vat, set into the wall, is a fan which draws the fumes off as they rise from the vat and exhausts them outside the wall of the building. The workpieces are allowed to remain in the pickling vat from 12 to 15 minutes, depending upon the amount of scale to be removed. While usually controlled in the forging operations so that the minimum amount of scale will be formed, occasionally the production routine is disturbed and more than the normal amount of scale will result.

From the pickle tanks the bumpers go to the rough polishing operation, which is performed with the aid of the straight-in-line automatic polishing machine shown in Fig. 3. The machine is equipped with 14 polishing wheels, aligned with a conveyor belt upon which the bumpers are carried beneath each wheel, in turn. Each polishing wheel is powered by a 10 h.p. motor, connected to the spindle by grooved pulleys and V-type belts. Heavy balance weights and dashpots prevent the polishing wheels from bouncing on the curves. Power is transmitted to the belt conveyor through an adjustable speed transmission, which makes it possible to

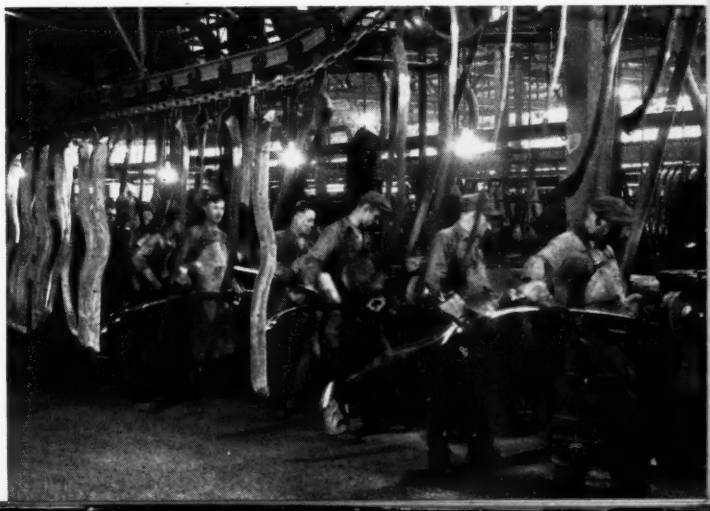

Fig. 4—Polishing the curved ends of the bumpers.

regulate the speed of the work past the polishing wheels. The machine does an excellent job on the flat surface of the bumper although it cannot, of course, follow the cylindrical contour of the ends.

As each bumper reaches the end of the automatic polishing machine it is removed and hung on a conveyor which carries it past the line of hand polishing machines shown in Fig. 4. Here the ends are polished by indi-

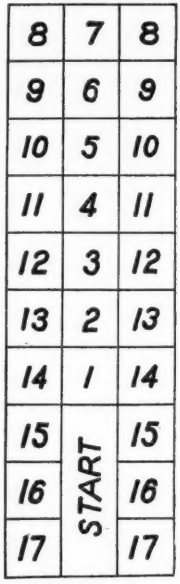

Fig. 5—Diagram illustrating layout of tanks in plating department.

vidual workmen, as shown, each making sure that all surfaces, except the back of the bumper, have been polished before the piece is allowed to pass on to the finishing automatic. The ends completed, it is hung on the conveyor line, which carries it to another series of automatic polishing machines where the finish polish operation is performed. The second polishing operation is performed with automatic polishing machine similar to those used for the rough polishing operation shown in Fig. 3. From here the bumpers are carried to the plating department on conveyors.

The tanks in the plating department are arranged in three rows, as shown in the diagram Fig. 5. Starting at the nearest end of the center row, the work passes from one bath to another for the entire length of this row and then is divided, one half of the work being processed in one of the outer rows of tanks and the other half of the work in the other outer row, the equipment and solutions in the outer rows being identical. The bumpers are transported in lots of 10 to 18 by means of carriers, each of which is suspended from trolley wheels that ride on an I-beam monorail.

The monorail extends the full length of each row of tanks, a switch at the far end of the center row being provided so that alternate loads can be shifted to one or the other of the outer rows of tanks as required. Between the tanks the monorail is firmly anchored, but directly over each tank is a section which, while fitting into the stationary monorail line, is disconnected from it and is suspended from a hoist, as shown in Fig. 6.

When a carrier with a load of work is properly located over one of the tanks, the monorail section can be lowered so as to dip the work into the tank, as shown. When the processing is complete, the section is again raised into position in the monorail line and the carrier is moved on to the next tank.

Starting at the nearest end of the center row, the bumpers are dipped into successive cleaning tanks filled with a commercial cleaning solution. After remaining in this solution for the required number of minutes, they are removed for rinsing in clear water. To make sure that every particle of alkali has been removed, the

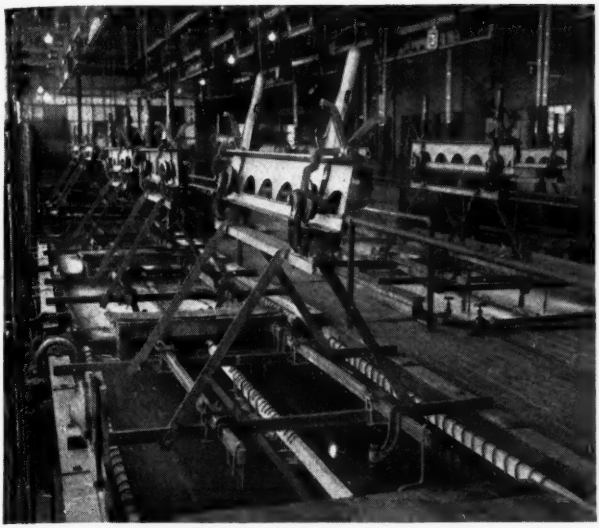

Fig. 6—Over each plating tank is an independent monorail section which, together with the rack carrying the work, can be lowered to dip the work-pieces into the solution.

fourth tank contains spray equipment which shoots a multitude of fine streams of clean water at the work-pieces from all directions. Here the bumpers are hand scrubbed, dipped and again sprayed, after which they are moved along to another clear water rinse.

By this time every particle of alkali or other foreign matter is washed off and the bumpers, chemically cleaned, are ready for plating. The two outer rows of cells are used for the plating operations and a time cycle has been developed so that the plating takes just twice the time in the respective plating cells that is required for the cleaning operations.

Before passing to the first plate, which is a nickel plate, the bars are dipped in an acid etch to prepare the surface to receive the plate. Now the bars are passed to successive plates of nickel, copper and nickel until, by the time they reach the end of the row of cells, they have received the desired amount of total plate which is approximately 0.0015 inch.

It is at this point where a word should be said about the laboratory (see Fig 1), because every solution must be kept in constant balance in order that good work may result. No changes are ever made in any of the solutions except by written orders from the chemist. Each day test pieces are removed from the production line and delivered to the laboratory for salt spray test, depth of plate, and so on. The current neces-

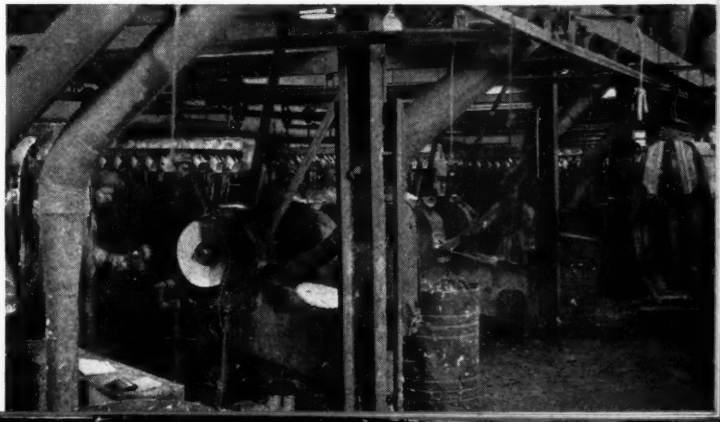

Fig. 7—Hand buffing the ends of the bumpers after plating.

Fig. 8—Striping is done with an air "flow-gun."

sary to accomplish all the nickel and copper plating is furnished by a group of generators consisting of a total of 30,000 amperes.

Having finished their journey through the plating line, the bumpers are now passed through an automatic buffing machine which buffs the face of the bumper, then the ends are buffed by hand. A view of the hand buffing line is shown in Fig. 7. This picture was taken from the end of the line, due to the fact that the conveyors carry the work so close to the front of the machines that it is impossible to obtain a good view of the machines in operation. The bumpers are now ready for the final plate, which is chromium.

The chromium plating line consists of eight tanks, the first two of which contain a commercial cleaning solution. The pieces are left in each of these tanks a specified number of minutes, then they are moved on to the rinse tank, where the cleaning solution is washed off. The next tank is an acid dip for the purpose of preparing the surface of the metal as explained before, and the fifth one is another rinse to remove all traces of acid.

This done, the bumpers are dipped into the chrome bath to receive a chrome plate approximately 0.00002 in. thick, after which they are removed and passed in consecutive order into a cold rinse and a hot rinse. Upon coming out of the hot rinse, the bumpers are sprayed with a coat of aluminum lacquer on the backs for clean appearance, and uniform color.

Again the bumpers are lightly buffed—this time by hand—to eliminate water marks, after which they are sent to the packing departments or to the striping bench, according to whether or not a stripe is needed. Some bumpers are perfectly plain, and some carry a longitudinal stripe. When a stripe is required, striping is done by hand with a "flow-gun", as shown in Fig. 8. The striping

(Continued on page 37)

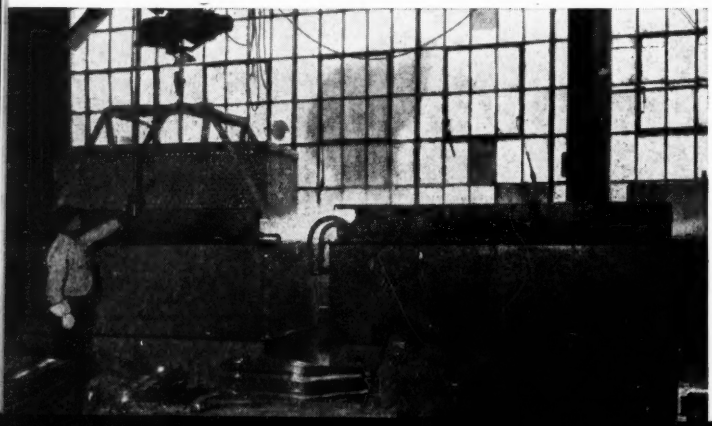

Fig. 9 — Bonderizing tanks in which the bumper arms are rust proofed before being enameled.

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Lacquer Finishes for Metal Products

In which the author offers a number of suggestions regarding the selection and application of various types of finishes

By M. H. Corbin
Technical Director—The Arco Company

THE term lacquer, in general, is synonymous with a quick drying hard film obtained primarily through the use of nitrocellulose coatings. Although the development of nitrocellulose lacquers is relatively new, their commercial application has grown so rapidly that the oleoresinous paint market has been appreciably affected. Speed of finishing was the attractive feature that caused the wide and rapid acceptance of lacquers. Naturally, the paint manufacturers felt that in order to maintain their paint markets it was necessary to speed up the drying time of their finishes—hence, the development of synthetics and four hour enamels and the transition of the paint industry from an art to a science. The chemistry of paints, their manufacture, application, protective value, etc. were made problems for research. As in most cases, applied chemistry and chemical research generally resulted in a synthesis to replace a natural heterogeneous product.

Progress in protective coating has been astonishingly rapid, due primarily to the development of synthetic resins. The advance in the manufacture of synthetics also contributed further stimuli for the formulation of lacquers. The work not only led to better lacquers with higher solids, better build, and more durable finishes, but also to basically new film forming materials.

The transition in the lacquer industry is toward the use of high resin material. Heretofore, resins or gums were used to modify nitrocellulose films, and now—broadly speaking—nitrocellulose is used to modify resin film.

Other cellulose esters and ethers are finding their special uses in the

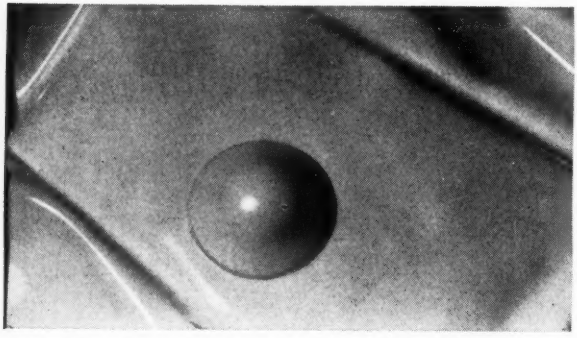


Fig. 1—Brass panel finished by the one-coat lacquer system. The panel was finished in the flat sheet, then drawn and formed without rupturing the lacquer film.

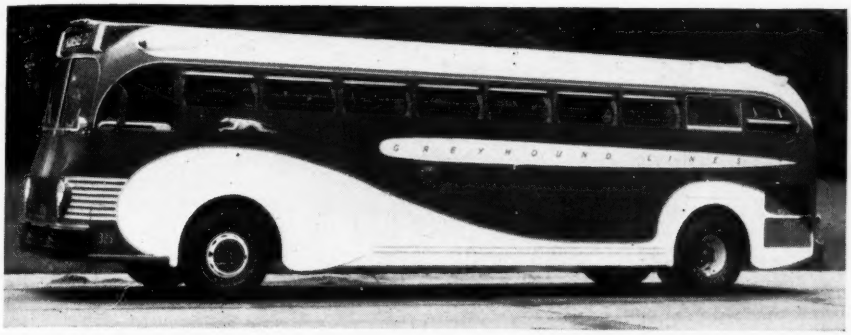


Fig. 2—Bus finished with a high solid synthetic lacquer.

protective coating industry. This is also true of rubber resins whose drying is similar to that of nitrocellulose films, viz. by the evaporation of their solvents.

In the past the finishing industry ordinarily looked upon lacquers as a finish coat, and recommendations were made that oleoresinous primers be used as undercoats. The reason for this was that lacquer could not originally be made so that it would adhere satisfactorily to metal. Today, however, in a great number of instances one coat of lacquer is sufficient. Lacquers can now be made to adhere tenaciously to most metal surfaces and retain their flexibility without sacrificing any of the hardness characteristic to nitrocellulose finishes. An example of this flexibility is illustrated in Fig. 1.

This type of finish is very adaptable to metal novelties, particularly where the articles are stamped and formed. In such cases the objects can usually be finished in the metal sheet, the lacquer having sufficient adhesion and flexibility to withstand the stamping and forming operations. Finishing by this method reduces the cost considerably over that of finishing small metal parts individually. With this new type of lacquer another saving can be effected, where, in the past, priming coats were used followed by one coat of finishing lacquer. The two-coat system can generally be replaced by one coat of lacquer, depending, of course, upon the type of finish required. Where a certain amount of filling is desired and sanding operations are necessary, a two-coat system is still required.

The success or failure of any finishing depends to a considerable extent upon the method and degree of cleaning the metal surface. Different metals require different treatments. Fundamentally, it is necessary to free the surface of grease, oil, rust, and so on. Also, in some cases a slight etching or sanding of the metal surface increases the adhesion of the protective coating.

Vapor cleaning, which is one of the newer methods, is becoming very popular as it does an unusually efficient job. This method consists of heating a chlorinated solvent to a high temperature so that the upper part of the container chamber is filled with the solvent vapor. When a cold metallic object is immersed in the vapor, the solvent condenses on the metal and dissolves the grease, oil, and so on, and then runs off. By this method the cleaning is always carried on with clean solvent which does not leave any oily residue on the

surface of the metal.

Using a mixture of phosphoric acid and solvent is also an effective method for cleaning the metal. The acid gives a slight etch to the surface of the metal, while the solvent combination dissolves the grease. A wetting agent in this solvent-acid mixture increases its efficiency and wetting properties. You will find these materials sold under various trade names.

Chemical coatings such as bonderizing, parkerizing, etc. are also effective in obtaining clean surfaces. Alkaline cleaners, sand blasting, and chromic acid etches may also be used for various types of metal under special conditions.

Zinc reacts with most organic coatings. Therefore, acetic acid washes contribute to the initial adhesion of the finishes. But the most satisfactory method of preparing this metal is to deposit on the surface an inert metallic compound that will not be absorbed into the zinc, and at the same time will not react with the paint film. A dip depositing a nickel compound has proven very effective in this instance for obtaining the lasting adhesion of paint films.

As commonly accepted, glycerolphthalate enamels have comparatively outstanding durability, particularly in relation to the retention of their original lustre on exposure to atmospheric conditions. The presence of relatively small amounts of nitrocellulose or ethyl cellulose in these enamels not only increases their durability, but also increases their speed of drying so that it approaches that of the orthodox type of nitrocellulose lacquer.

This finish is particularly adapted to automotive and bus finishing, where durability, lustre retention, etc. are important factors. Manufacturers have reduced the time required for the finishing of buses by the use of a "synthetic lacquer system".

The usual method is to apply one coat of oleoresinous primer which is allowed to dry over night. This is followed by one coat either of lacquer or of synthetic surfacer. The material is then allowed to dry four to six hours in the case of the lacquer surfacer or over night in the case of a synthetic surfacer. After the surface has dried, six to eight coats of lacquer are applied, and the following day it is polished or buffed.

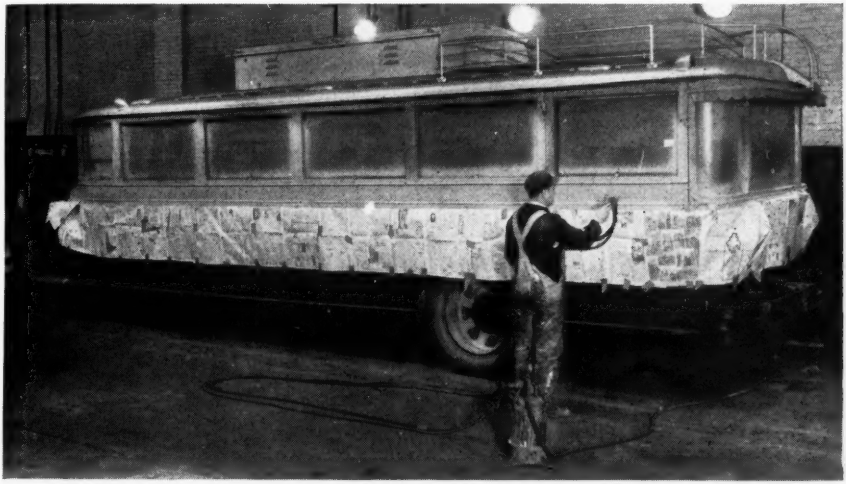
Synthetic and high solid synthetic lacquers have reduced the time element in this system, and at the same time give a more durable finish. The metal is first cleaned thoroughly with phosphoric acid and solvent, and then dried. One thin coat of a zinc chromate primer is applied in the morning. It is allowed to dry about five to six hours, and a synthetic surfacer is applied the same day. The surfacer is formulated in such a manner that it provides the maximum filling, having 63 per cent solids at spraying consistency. This is allowed to dry over night, and is then sanded either dry or with naphtha the next morning. Finally, three coats of high solid synthetic lacquer are applied in the afternoon and the job is ready to leave the shop or plant the next morning. This material has sufficient lustre so that polishing is not necessary.

In actual production this system has shown considerable saving in materials used, in labor, and in time required for finishing. Moreover, the undercoats; viz. the primer and surfacer, could be "forced dried" or baked and the time element thus further reduced. This finish is particularly adapted to aluminum and aluminum alloy bus bodies, because it adheres firmly to these metals, resulting in a hard tough film that will not check or crack when exposed to rapid changes of temperature. This factor is of paramount importance in finishing buses such as

that shown in Fig. 2. For example, when a bus travels in sub-zero temperatures in winter and is driven into a warm garage, the metal will expand. This rapid change in temperature has been known to cause the finish to crack and break off from the metal.

is air dried or "forced dried".

After this one coat of alumiuum bronze is applied. The aluminum bronze vehicle is so made that maximum leafing of the aluminum is obtained, and at the same time the solvents are so established that they will not "bite" or attack the primer-



Refinishing is easy and economical with the modern air gun.
(Photo Courtesy The DeVilbiss Co.)

The metal casket industry almost universally uses lead-coated metal for their structural work. This type of surface, being soft and reactive with paint films, presents some interesting problems. The system in general is to first glaze the surface, to fill up the file marks and rough spots, and then to apply one coat of primer surfacer. This is usually a nitrocellulose lacquer film carrying sufficient amounts of inert pigments and color to give maximum "filling" without destroying its adhesive properties. Adhesion, sanding properties, "hold-out" ability, and drying qualities are the characteristics looked for in the primer surfacer. This material surfacer. After this has dried, two or three coats of clear lacquer are applied. Following drying, the finish is brought up to a high polish.

For casket work it is necessary that the finish have depth and clarity, and not be affected appreciably by exposure to light. The working properties of the system have to be adjusted to meet the varied conditions in the different factories.

The life of chemical finishing and coloring of metal as done in the hardware industry depends to a large extent upon the protection afforded by lacquers. It is, therefore, essential to obtain the best grade of metal lacquers, formulated definitely for that

purpose. Oxidized silver and copper objects require, first of all, a lacquer that will not promote "spotting out" of the finish. "Spotting out" of oxidized finishes has caused the rejection and return of large quantities of goods. A thorough study of this difficulty was made by the Plating Division of the Bureau of Standards, and it was found that some types of "spotting out" were due to lacquer finishes. However, today "spotting out" due to lacquer characteristics has been eliminated. Adhesion, hardness, and flexibility are essential properties of hardware lacquers. They should flow out smoothly and with a uniform gloss surface.

Dipping and spraying are the more general means of application. However, some small objects are tumbled or centrifuged. Although "water dip" lacquers are used to some extent, they are rarely recommended.

There are cases where the lacquer finish is buffed or brought to a gloss glass-like surface such as imitation cloisonne used on vanity cases, cigarette lighters, etc. In this case, the film must be hard and tough to withstand the buffing operation.

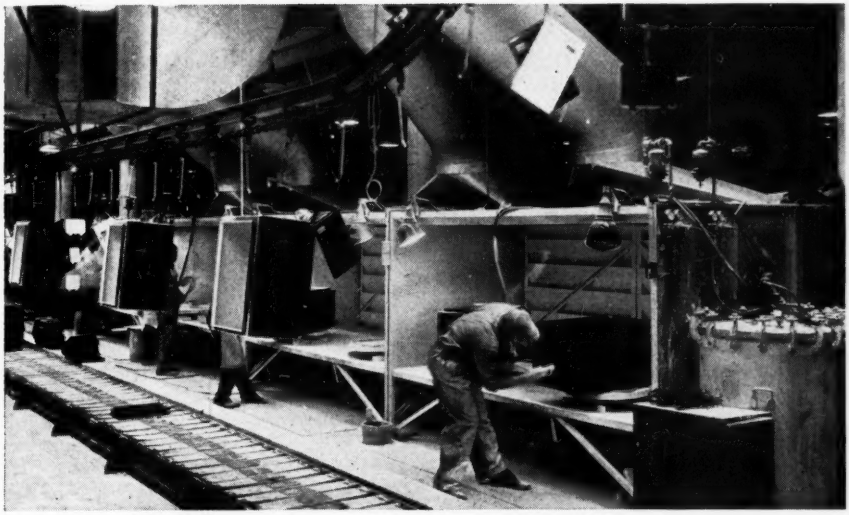
In a number of instances only portions of objects are to be plated and lacquer is used in this case to protect the portion of the object which is left unplated. Materials used for this purpose are called "stop-off" lacquers. This type of lacquer is also used to protect portions of the plating rack. By their use in this manner, greater cathode efficiency is obtained in the plating operation.

In the manufacturing of etched metal name plates, both clear and pigmented lacquers play an important part. In the case of colored background plates, after the designs are etched on the metal plate, but before the acid-resist is removed, a coat of colored lacquer is sprayed over the entire sheet. After drying, the plate is immersed for about fifteen minutes in a special solvent which softens the acid-resist under the lacquer, hence the lacquer on the high lights of the plate is easily removed, leaving the enamel in the background. After the sheet has dried, a coat of clear lacquer is either sprayed or coated over the entire sheet. When this is dry, the plates are cut, blanked to the proper size, and formed.

Here again, adhesion, flexibility, and hardness are of even greater importance than they are for the usual hardware lacquers. The lacquers must stand stamping, forming, cutting, blanking, and so on, without having the film ruptured. Since this industry uses almost all types of metal, it is an advantage to have one type of lacquer that has the same properties for different kinds of metal. This is now an accomplished fact, and the material can be obtained for roller coating, dipping, or spray application.

The making of instrument panels and garnish moulding is an allied industry where special finishing materials are required. These products were originally finished by forming the panel first, then applying the finish. However, the finishing is now done on the metal sheet first and it is formed afterward. A ground coat is applied, which is usually baked on. It is then grained, and one or two coats of clear lacquer are applied, followed in most cases by rubbing and polishing. After the sheet is finished, it is blanked and formed to the proper design. A lacquer decalcomania graining is also used extensively and a clear finishing lacquer is then applied over the surface.

The finishing of refrigerators presents other special requirements that have to be fulfilled. The general practice is to apply, by either spray or dip, one coat of primer which is baked for one-half to one hour at 325 deg. F.



Modern spray booths are designed for maximum production with a minimum of effort.
(Photo Courtesy The DeVilbiss Co.)

This coat is followed by one or two coats of lacquer enamel. In most cases the finish coat is a straight synthetic of the glycerol phthalate type, which is baked for two hours at 260 deg. or one hour at 300 deg. However, since this article deals fundamentally with lacquer materials we will confine our discussion to that type of finish. Although, initially, lacquer finishing coats were used exclusively, they were deficient in lustre and build. Synthetic lacquers are, however, re-entering the field, largely due to the fact that they provide all the properties of synthetics without the need of baking.

Refrigerator finishes must possess excellent humidity resistance, color stability, and grease and sulfur dioxide resistance. They must be hard, flexible, and tough. The standards for refrigerator finishes have been constantly increased, and the remarkable progress made in the chemistry of paints is particularly exemplified in refrigerator finishes.

Since metal is being used more extensively for equipment such as metal sinks, store fronts, and so on, it has become necessary to develop a finishing material which will eliminate the ring of the metal. This is now successfully accomplished by spraying one heavy coat of sound deadening lacquer on the back side of the metal. This type of lacquer is of a heavy body in which relatively large amount of cork and asbestos fibre are incorporated. A large nozzle spray gun having an opening of about 1/32 in. to 1/16 in. is used for applying the material, using about 10 to 15 lb. air pressure on a pressure feed tank, and about 40 lb. air pressure on the gun.

Finishers of automobiles and metal furniture have also taken advantage of the developments in the lacquer industry. Fewer coats are required and greater durability is obtained with synthetic lacquer than was heretofore possible with the orthodox type of nitrocellulose finishes.

Finishes to stand concentrated acids and alkalis in solution or fumes are

now possible with quick air drying materials, made on rubber resin bases. Originally adhesion was lacking with this type of finish. However, today this type of finish can be made to adhere satisfactorily to most metal surfaces without sacrificing its many other desirable properties. It is particularly adapted to metal equipment used in chemical plants, dairies, plating rooms, or other places where corrosive conditions exist.

Golf club shafts, fishing rods, radio parts, dials, clocks, and similar products, all present their individual methods and problems of finishing. It is very apparent that industrial lacquers, enamels, and paints must be "tailor made" and engineered from beginning to end. To successfully formulate a material for any finishing operation a thorough study should be made of plant conditions, objects to be finished, schedule of finishing, as well as facilities available. After the material is formulated and tested in the laboratory, the finish should be tested under actual plant conditions. Although it requires more time and work to do this, it has been proved in many cases that finishing costs are reduced considerably and at the same time better and more adaptable finishes are obtained.

HOW TO USE "HANDY" SILVER SOLDERS, SIL-FOS, AND EASY-FLO BRAZING ALLOYS. As a service to their customers and all other users of silver solders and brazing alloys, Hardy & Harman, 82 Fulton St., New York City, have published a new bulletin entitled "How to Use 'Handy' Silver Solders, Sil-Fos and Easy-Flo Brazing Alloys."

Silver alloys for soldering and brazing have for years been studied at the research laboratory of Handy & Harman, Bridgeport, Conn. There fluxes, torches, furnaces and cleaning methods, in addition to strength and soundness of joint and the effects which various temperatures have on many metal structures, have been tested and observed. Such theories as were thus developed have since been tried under all kinds of working conditions in many plants throughout the country.

The results of both laboratory and actual production data are contained in the new booklet which includes detailed instructions and two pages of hints on the subject of soldering and brazing with silver alloys. The recommended procedure to be followed in the making of lap, but, and sheer joints is illustrated with views of joints which have proven to be unsatisfactory and for this reason should be avoided.

Of especial interest should be the pictures and directions telling how to save time, gas, and air when joining both ferrous and non-ferrous metals. On page 6 of the eight page booklet is found a valuable reference table to "Handy" silver solder which lists names, melting points, colors, and uses of the sixteen standard alloys manufactured by Handy & Harman. Copy free to mechanical executives upon request.

ROSS INDUSTRIAL OVENS BULLETIN No. 123. The J. O. Ross Engineering Corporation, 350 Madison Ave., New York, N. Y., announce their bulletin, Ross Industrial Ovens in which they describe industrial ovens for drying, baking, and processing. The 14 pages are divided into three sections. The first section covering oven construction; the second, method of heating; and the third, material handling. In each section is a brief analysis of the subject. Illustrations aid in describing the many applications of Ross industrial ovens. Copy free upon request.

NEW M & W ENAMEL FINISH FOR DIE CASTINGS. The difficult problem of developing an enamel finish that will adhere tenaciously and continuously to zinc has been successfully solved by Maas & Waldstein Co., Newark, New Jersey, according to an announcement by that company. As a result of their research work, Mass & Waldstein are now placing on the market a new line of air-drying lacquer enamels which are especially designed for finishing aluminum die castings. These die-casting lacquer enamels produce an excellent, durable, elastic finish in one coat. They are supplied in gloss and egg-shell sheens and in white, black, and thirty-two standard shades. Special colors can be supplied when desired.

Have you filled in the information requested on the yellow card? If not, please do so now and mail it to PRODUCTS FINISHING.

The Editor's Page

THE flood of congratulatory comments received following the publication of the first number of PRODUCTS FINISHING convinced us that we were correct in our estimate of the opportunity that existed for a high grade magazine to serve the metal finishing field. To those of our friends who extended their congratulations, and to the manufacturers who expressed their confidence of our ability to successfully carry on the task we have set for ourselves by giving us their material support, we wish to express our appreciation.

Sensing a similar opportunity for service in the metal manufacturing field some eight and one-half years ago, and in the face of competition from several old, long-established periodicals, the publishers of this paper launched the magazine known as "Modern Machine Shop." Today "Modern Machine Shop" is carrying more business per issue than any other magazine in its field, and is led slightly by only one other paper among all the industrial magazines in the United States.

From an idea to the leading magazine in its field in eight and a half years has not been a simple task; it has been due to carefully-defined editorial policies, a high standard of business and publishing ethics, and — what is most important — sensitivity to the needs of the industry and unlimited effort toward the end of meeting those needs.

Again we have sensed an opportunity for service; again we have launched a new magazine— this time to bring to the metal finishing industry the newest and best information available regarding developments pertinent to the industry. This magazine is dedicated to its readers, and any suggestions or recommendations that the readers may care to offer will be gladly received.

Measuring Abrasiveness

By Henry R. Power
The Carborundum Company, Niagara Falls, N. Y.

THE resistance of certain materials to abrasion, or conversely, the abrasiveness of other material, are, of course, relative terms, requiring definitions of the materials abraded and of the methods used to bring them into contact. For instance, the resistance of the human foot to abrasion requires a definition of the owner of this extremity—whether it be the leathered or calloused—which simply illustrates the importance of the choice of materials for test.

Abrasiveness may be considered a commercial term in which are combined many properties like hardness, toughness, tensile strength, and so on. A terrazzo floor made from marble chips of hardness 3 (Moh) will show shorter life than one from chips of bonded "Aloxite", electrically fused Alumina, of a hardness of 9. The surprising long life of certain installations of marble terrazzo floors may be due to the smoothness to which they have been rubbed by "Carborundum" rubbing brick plus the absence of attrition material like mud, formerly carried on the shoes of men.

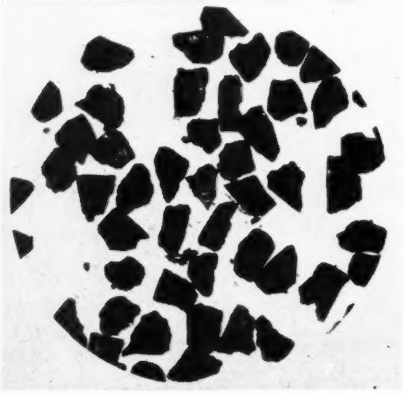


Fig. 1—Silicon Carbide Grains Used for Determining the Toughness of Lacquer Films.

The absence of friction in a marble chip terrazzo floor is noticed when a wet rubber heel skids rapidly over it. Bonded aluminous abrasive, on the contrary, has a high coefficient of friction, both wet and dry, and is therefore a good non-slip surface, hence a safer one. The resistance of the bonded abrasive to acids also makes it preferable for use as a flooring material in the plating room.

The abrasion resistance of paints, varnishes and lacquers is important because of their use on motor vehicles which come into contact with road dusts, including sand, granite and all the rock forming minerals, other vehicles when parked or in transit, garage doors, and so on. To evaluate the abrasion resistance of paint materials, Schuh & Kern (Jour. Ind. & Eng. Chemistry Analytical Edition, Vol. 3, No. 1, P. 72) have selected "Carborundum" powder of uniform particle size, and have directed it at a constant rate, by a stream of air, onto the sample under test. The weight of Carborundum required to wear through a unit thickness of paint material is taken as the abrasion resistance of the material under test. Apparently no attention is paid to the shape of the abrasive used. Their success with this method led the authors to believe that it can be used on the electroplated metals chromium, zinc

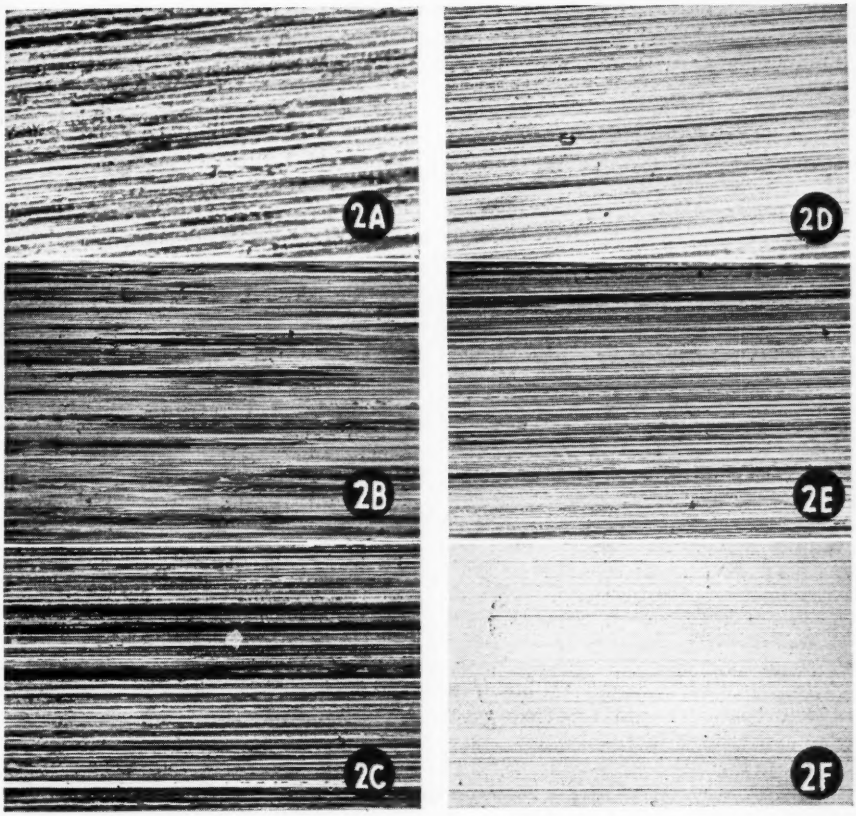


Fig. 2—Types of Finish Illustrating Degrees of Abrasiveness. (a) Surface ground with 120 grit grinding wheel. (b) Same surface lapped with Silicon Carbide 320 grit, wood lap. Surface torn, having wide valleys and ridges. (c) Same surface finished with 120 grit Aluminous abrasive cloth. (d) Same surface lapped with 120 grit Aluminous abrasive cloth and finished with 220 Aluminous abrasive grain (dry) leather lap. Time, 10 seconds. Higher finish conceals imperfections. (e) Same surface lapped with W7 Medium Finishing Compound, wood lap. Time, 3 seconds. Not so high a finish as D, but better in surface. (f) Same surface lapped with W7 Medium Finishing Compound, hard felt lap. Time, 4 seconds. Finish commercially perfect.

and cadmium, originally selected for their corrosion resistance, but which must withstand abrasion resistance as well.

To a degree, the blasting operation with the brasive just described is an impact test, though the sharpness of the abrasive used makes it also an abrasion test. Another impact test, in which abrasion is not a factor, uses a round steel ball to measure the ductility of a coating material. In this test the ball under controlled velocity strikes continually until the bare panel is exposed.

Surface hardness of a film is also measured by scratching the film under controlled conditions and examining

scratch produced. The scratch is formed by a hardened steel point, standardized in shape, because the shape of the point affects the results. A special instrument to illuminate the scratch and measure its width has been developed, even permits of photographs of the scratch for permanent record. The width of scratch is plotted against the load on the scratching point. This is described by Sheppard & Schmitt, Jour. Ind. & Eng. Chem., Analystical Edition, Vol. 4, July, 1932, P. 302. The composition of the material of which the style or point is made, affects the results, and abrasives like Carbide of Silicon and Electrically Fused Alumina would give wider, deeper scratches than steel, though the latter is satisfactory on the films tested like cellulosic derivatives, nitro-cellulose, cellulose acetate, and so on.

The polishing of a metal surface produces a succession of scratches, comparatively deep and wide at first, then narrower and shallower until the desired finish is attained. Final operations like buffing may result in true abrasion, in which molecules are actually torn from the surface, leaving scratch lines small in diameter compared with the wave length of visible light. On the other hand, the effect produced may not be abrasion at all, but rather a viscous flow which involves sliding the surface molecules into adjacent positions where they fill up miscroscopic pits or scratches. The measurement of "finish" of metals may therefore be indirectly a test of abrasiveness.

In most polishing shops adherence to a standard is measured visually by comparing the day's production with a Master set-up for the inspector's use. Because the biologist tells us that what we see depends as much on the peculiar reactions of the individual eye as on the stimuli themselves, attempts have been made to eliminate visual inspection and to determine the exact geometrical condition of a surface. If this can be done and expressed in mathematical terms, the fallible human judgment will no longer be exercised in passing upon say the excellence of polish, the efficiency of types of abrasives, the degree of smoothness, and other factors.

Perhaps the smoothest metal surface that can be produced is that of the so-called "pancro-mirror", made by depositing aluminum by means of evaporation in a vacuum chamber on polished glass. The now famous Corning glass disk will be so coated. Such a surface reflects light with 93 per cent efficiency and reflects all colors alike. A silver mirror reflects only 81 per cent with violet light. From this extreme of perfection, metal is finished commercially with all the grades down to the well known Matte finish.

One method of measuring commercial finish physically, is to move a sapphire point pick-up, the point being run over the surface, connected to an amplifier system. The amplifier yields sound waves, the pitch and regularity of which are observed. Another method focuses a beam of light on the metal surface in such a manner that it will be reflected on a sensitive cell. As the specimen moves along under the beam, any microscopic hills or valleys will register as fluctuations in the electric current produced by the cell due to variations in the reflected light. Thus the personal element is entirely lacking and an accurate record is obtained.

While the measurement of the degree of polish of metals can be done optically by determining the reflectivity, this is not possible with all materials. For instance, a white blotting paper surface has a high reflection factor but no polish, while polished black slate has a low reflection factor but a high polish. A white

porcelain surface has its high reflection masked by diffuse reflection. With metals, however, a high degree of polish and high reflectivity go along together, and both freshly polished metals and those that were tarnished can be measured by the use of special optical apparatus.

AMERICAN DUSTUBE DUST CONTROL DATA BOOK. "American Dustube Dust Control" is the title of the 24-page Data Book Number 22 just issued by The American Foundry Equipment Company, 555 Byrkit St., Mishawaka, Ind.

One half of this book is devoted to description, illustration and drawings of the American Dustube Dust Collector, and describes its application to dust control problems in detail.

There are features of this equipment such as materials that can be collected, the operation of the Dustube, the shaker, the Dustube housing and its assembly are featured sections of this part of the book.

The center spread is devoted to detailed drawings showing the many features and their application to individual problems.

The last half of the book is devoted to engineering data of interest to the technical man as well as the practical shop man in the solution of dust control problems and the maintenance of dust control equipment. Some of these captions are headed "Specifications for Exhaust Piping", "Care of Dust Control System", "Static Pressure Readings and How to Take Them", "Air Volumes in Pipe Lines at Various Velocities", and "Dust Control Analysis Sheet".

In addition to these detailed instructions there are easily understood charts and drawings to facilitate the answering of practically all of the dust control problems which may come to the attention of the maintenance man or those concerned with original purchase of dust control equipment. Copy upon request.

METSO 99 BOOKLET. The Philadelphia Quartz Co., Philadelphia, Pa., has issued an eight page booklet entitled "Metso 99, Sodium Sesquisilicate, for Modern Industry's Cleaning Needs." Installations where Metso 99 is used to good advantage are described in the text and illustrated by photographs. Platers interested in removing paraffin oils, drawing compounds, and lubricating greases without the aid of sprays or electric current will find helpful information in this booklet. Copy free.

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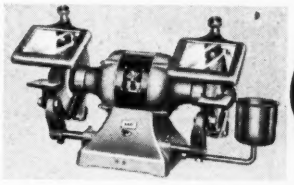

SKF ball bearings, a motor that has plenty of capacity to handle steady, heavy production work with high efficiency and low current consumption, 7" guarded wheels—those are the sort of engineered quality features that have made this grinder preferred by hundreds of shops.

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Engineered **POWER TOOLS**

A Gentleman Goes To Work

A brief resume of recent developments in hard chromium plating.

By W. E. Bancroft

Pratt & Whitney Division, Niles-Bement-Pond Co.

POPULAR conception holds chromium plating as a means of putting a product into fancy dress. We have become accustomed to modern gadgets in gleaming chromium, plated purely for decoration and a permanent finish. Every store window is a shining display of the decorative value of chromium. Every automobile has its bright parts plated.

But chromium plate, the gentleman, also can be chromium plate, the hard boiled laborer. In the latter form it is known as hard plating, as compared with decorative plating. Hard plate is being used more every day, but it still is an unknown quantity to many manufacturers.

It will be well to differentiate between these two types of chromium plating right at the start. Decorative plating, which is sometimes called a "metallic lacquer", is used for appearance. It is only about .00003" thick, and usually is applied on a copper or nickle base. This means that the softer metal is immediately under the extremely thin layer of chromium, and results in a surface which is not capable of withstanding

Fig. 1—View of Modern Plating Room.

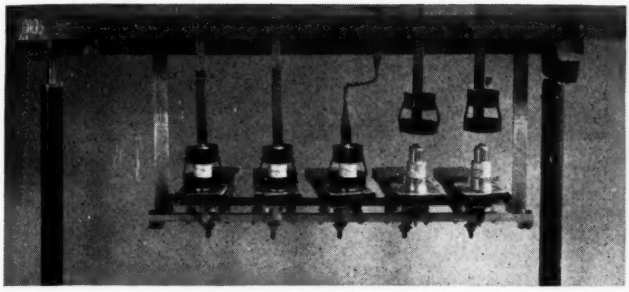

Fig. 2—Special Plating Racks.

wear or pressure as a bearing. This is the real reason why some men refuse to use chromium plate. They have expected high wear from decorative plating—a finish that is never intended for anything but decoration, as its name implies. Hard plate would have been satisfactory.

It is a popular belief that decorative plating resists corrosion. This is true, but not entirely because of the chromium itself. Usually it is the nickle or copper underneath which resists corrosion, and the chromium is only an added effect. The very thin sheet of chromium usually has very minute imperfections which would permit oxidization of the metal beneath and actual loosening of the plate were it not for the protective coating of cooper or nickle.

Hard plate is of a very different nature, and always is done directly on the base metal, which frequently is steel. It is of two kinds, known as flash plating and heavy plating. Flash plating is of thickness up to approximately .0005" depth of plate, and usually is not finished to size afterwards. Heavy plating differs only by being thicker than flash plating. Frequently it is carried to depths of .010", and can be as thick as .045" successfully. Heavy plating usually is finished to size afterwards by grinding or lapping.

A shop equipped for decorative plating usually cannot do successful hard plating, and vice versa. The two processes differ widely and require different types of equipment. Hard plating is not easy, and involves much detail which does not enter into decorative plating at all. Its successful operation depends on a rather extensive knowledge of the electrochemistry involved. At its best chromium plating is done at an extremely low plating efficiency and requires a low constant voltage, the latter usually being supplied by special power source. The trick is to deposit the plate evenly regardless of the shape of the piece being plated. The result has been the development of rather complicated and ingenious racks for holding the parts. Much time and research has been spent on the mechanics of properly designed racks and anodes. These racks involve carefully worked out distances between the anodes and the parts to be plated, and the use of "thiefs" to prevent excessive build up of plate on sharp corners and edges. The proper design and building of racks for hard plating is a study in itself.

Figure 1 shows a typical modern chromium plating room with the

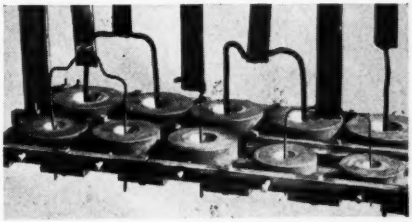

Fig. 3—Typical Rack for Plating Special Work.

various cleaning and plating tanks properly set up for convenient operation. Part of the low voltage current supply system with its heavy bus bar equipment can be seen. This particular shop also is equipped with a blower system to evacuate the fumes always present in the process. Figures 2, 3 and 4 show typical racks developed for plating various pieces. Notice particularly the careful details which are necessary in order to complete these plating jobs successfully. Such racks are made in the plating shop as they are needed, and stored against repeat orders.

Hard chromium plate is used as a means of surfacing parts to produce high wear resistance. On the other hand hard plating has become industry's chief building up tool to salvage worn or spoiled parts. Each of these fields is becoming increasingly important, and the use of chromium more and more widespread.

Hard chromium plate on a surface which is to have a rotating action in a cylindrical bearing has caused much grief. Due to faulty plating work there have been many instances where the chromium has peeled off and ruined the bearing. However the job can be done with complete satisfaction if proper care is taken. A good example of this would be a small motor shaft with chromium plated bearing surfaces revolving in cylindrical bearings. This practice has proved satisfactory. Chromium plated bearing surfaces for sliding fits or for surfaces subjected to pressure, such as a die cavity, is excellent practice and is proving highly successful. For example Figure 5 shows a typical rubber mold for the making of rubber heels. This is made of soft steel and is stamped out, after which it is polished and buffed bright and smooth. It is then chromium plated to a thickness of .0005" to .0006", and afterward buffed to a bright finish. In rubber molds of this sort the chromium plating prevents the pitting of the steel base by rubber compounds, and it gives a thin surface skin of hard material which is extremely effective in reducing the abrasive action always present in such a mold. The chromium surface does not tarnish but re-

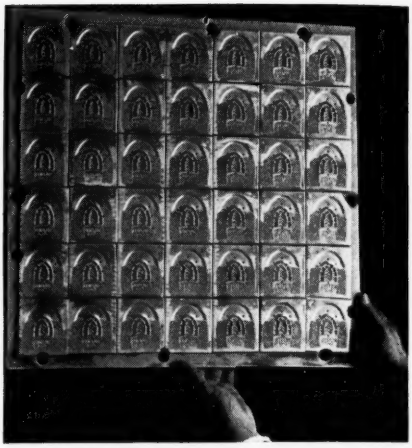

Fig. 5—Rubber mold, chromium plated to prevent pitting by rubber compounds.

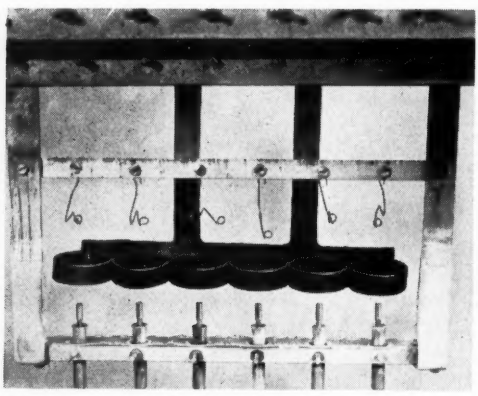

Fig. 4—The distance between the anode and the work is carefully calculated.

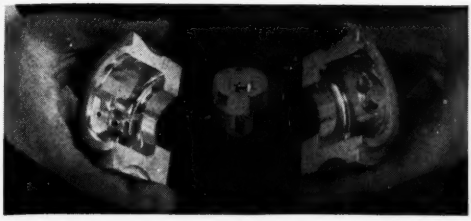

Fig. 6—Bakelite molds are chromium plated to resist wear.

tains its luster in use, and produces rubber articles with a brighter surface. The chromium also successfully prevents the sticking of the rubber to the mold which otherwise happens frequently. The chromium plating of rubber molds is completely successful and is being followed very widely. It is safe to say that it eventually will become universal practice.

Another type of mold being chromium plated is used in the plastic industry. Figure 6 shows a typical bakelite mold in three parts, which is made of hardened tool steel which has been polished and buffed to a smooth bright surface. In this case the plate thickness usually is between .0003" and .0004" on complicated shapes. Heavier plates than this undoubtedly will wear longer, but they also will tend to distort the shape of the mold and will require more polishing after plating. In any case the chromium plating is extremely effective in resisting wear, and in keeping the surface bright and smooth which is so necessary in plastic molding. It also prevents the plastic material from sticking to the mold and in some cases prevents pitting of the steel. There are no definite figures which will authentically compare the life of a chromium plated plastic mold with that of an unplated steel mold, but it has been said frequently that the plated mold will have at least twice the life. In addition the chromium plated mold does not require the frequent polishing that the unplated one will, and it also produces a much better finish on the molded article. Practice in the production of bakelite molds indicates that these eventually will all be chromium plated.

Figure 7 shows several small valve stems made of brass which have been rough centerless ground before plating to .003" undersize. This valve has a reciprocating motion to open and close the ports in a small power tool. The valve stem was plated to provide a hard surface for wear resistance. The total thickness of plate is .003" which brings the part .003" oversize and permits grinding to final diameter. The plating was carried out with great care. The length of the lands is important because they govern the time of the valve opening.

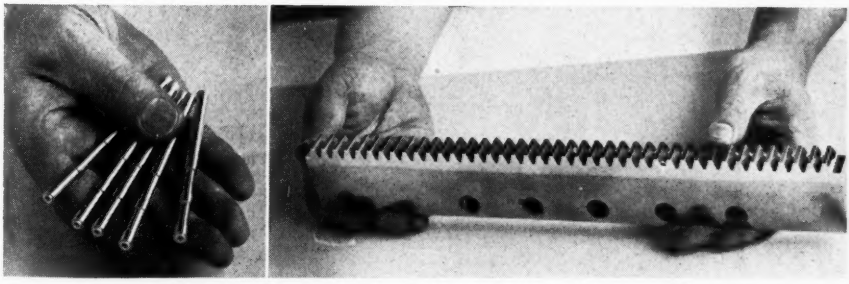

Fig. 7 (Left)—Valve stems, chromium-plated for wear resistance. Fig. 8 (Right)—Rack for machine tools, chromium-plated to maintain accuracy.

The sharp corners are equally important to get proper valve cut off, and the accurate diameter is necessary for a proper fit. In this case the chromium plate produces the high wear resistance qualities that would have been totally impossible with bare brass. This is typical of modern practice on many small parts which can be produced quickly and cheaply from the lesser metals, and then given the necessary hard surface by means of chromium plating. It also should be noticed that had these valve stems been turned out too much undersize by careless production, that they could have been brought back and salvaged by manipulation in the chromium plating process. This is an important factor in keeping down production costs due to spoiled work.

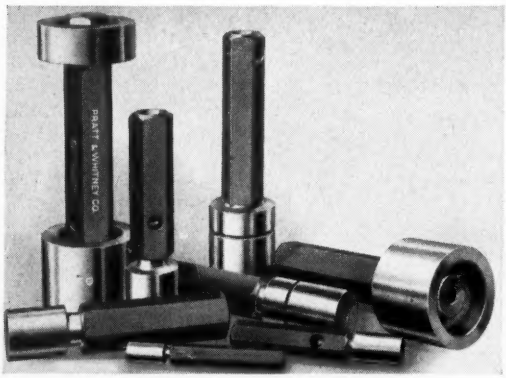

Fig. 9—Chromium-plated plug gages give from three to five times the service obtained from unplated gages.

Figure 8 shows a master rack used in a hydraulic gear grinder. This rack, in connection with an equally accurate master gear, controls the accuracy of the entire machine. The rack is made of steel and is chromium plated to maintain its initial accuracy to the utmost. For best results in this particular job a special anode is required which is located right in between the teeth. It is a very delicate mechanical setup in order to maintain the accuracy of tooth outline and spacing, but the results obtained justify the expense involved. This rack is ground both before and after plating, and the finished article has a residual thickness of plate of .002". The corners are slightly broken, both before and after plating, to prevent chipping. Chromium plating on this machine tool part resulted in at least double the life of the same piece unplated. This is a typical example of the very excellent service hard chromium plating is rendering in the more efficient functioning of the modern machine tool.

Chromium plating is rapidly becoming almost 100% standard practice as a finish for the ordinary types of production gage equipment. Figure 9 shows a group of typical cylindrical plug gages which when chromium plated invariably give from three to five times the service obtained from hardened steel unplated gages. The blanks for these gages usually are tempered to about Rockwell C 58-60 to relieve all hardening strains and hence to minimize the tendency to-

Fig. 10—This worn spline gage was built up by chromium plating and then reground.

ward cracking. This is necessary because the plating operation always tends to aggravate any internal strain or brittleness which the steel may possess. After this tempering operation such gages are plated and finished to size, leaving at least .0015" residual thickness of plate. Many parts used in production gages are being plated profitably with the direct benefits of increased life and lower initial and replacement costs. Of course any of these parts when worn beyond the prescribed limits may be replated and refinished at a fraction of the cost of making new gages. Figure 10 shows a typical spline gage which had been in use for sometime and had become worn beyond the useable limits. Its gaging surfaces were built up by chromium plating and then refinished to initial accuracy by grinding. This gage was salvaged and made as good as new for a very small fraction of its initial cost.

Much has been tried and accomplished in hard chromium plating cutting tools for increased wear resistance, but this as standard practice is still questionable. Chromium plated tools possess a fairly high degree of brittleness due to the absorption of occluded hydrogen during the plating operation, but this condition can be relieved by suitable heat treatment. Chromium plated taps and similar threaded tools have not been entirely successful because the chromium has a tendency to chip on sharp corners, or they do not give sufficiently superior life over unplated tools to warrant the extra expense. Reamers on the other hand, when properly chromium plated, and when used on nonferrous materials (or in a few cases on cast iron), have shown a very much increased life. Chromium plated carbon and high speed steel reamers have been used with good economy on machining aluminum alloys.

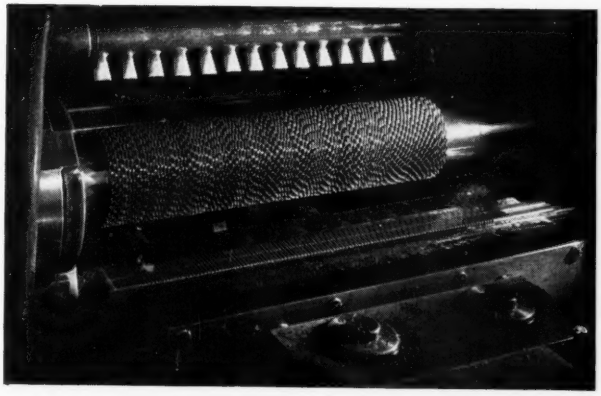

Fig. 11—Cast iron dust cannot build up on chromium-plated slotting saws.

Chromium has been used successfully on high speed steel screw slotters and saws. These tools, especially when used on cast iron, prove superior to unplated saws because the fine cast iron dust cannot build up on the chromium plate as would happen otherwise. Figure 11 shows a gang of typical chromium plated saws set up ready for use.

There is no question but that the future will show an increasing use of hard chromium plating on certain types of cutting tools, but at the present time the practice is not at all general.

We already have mentioned chromium plate as a salvage tool to reclaim spoiled or worn parts. This use became very great as soon as plating was developed successfully to thick-

nesses up to .045". It now is possible, with properly designed racks and equipment, to build up undersize surfaces for refinishing to correct dimensions. By this means parts which represent heavy manufacturing investments can be saved from the scrap pile and be made better than new for a comparatively small expenditure in plating.

There is one thing which apparently is not properly understood in the use of hard chromium plating. Many men seem to think that surface imperfections can be filled up and smoothed out by the plating process. This is not true. The surface of the plate should not be expected to be any smoother or better than the surface to which the plate is applied. In other words the work should be thoroughly polished as it is manufactured, or the chromium plating shop should be given instructions for proper finishing before plating. It is a difficult question to decide whether this initial polishing should be done in the chromium plating shop or in the manufacturing shop. In the case of die cavities or molds it is best to control the final finishing of the cavity before plating in the shop which makes the mold, so that correct sizes can be maintained and the polishing operation not be allowed to distort the true cavity size. However on a majority of other work where there is sufficient tolerance for the polishing operation not to make any difference, this initial polishing can be done more economically in the chromium plating shop. That is why most plating shops carry considerable flexible shaft and grinding equipment for the purpose. A typical setup for buffing a large chromium plated roll both before and after plating is shown in Figure 12. Modern flexible shaft equipment, with its multiple of attachments for reaching all sorts of corners and shapes, is very well adapted for this work and is widely used. Much disappointment in hard chromium plating, however, can be avoided if an intelligent analysis is given to the finish ultimately desired, and proper preparations of the surface made for that finish before the plating operation is begun. Complete cooperation and understanding between the manufacturing shop and the plating shop cannot fail to result in a better product. The hard, wear resisting, friction reducing surface of

Fig. 12—Buffing a chromium-plated roll.

chromium is a distinct advantage in many places now, and new uses for it are being developed every day. Analysis of the tools and equipment in any manufacturing plant will disclose many places where chromium plating would prolong life, maintain accuracy, and reduce maintenance costs.

Finishing Auto Bumpers

(Continued from page 16)

enamel, which is thick and heavy, is forced out of the gun by air pressure, but instead of coming out in the form of spray, is applied as a thin, smooth ribbon of the width required. The mechanic shown in the illustration is expert at striping, drawing a stripe of the correct width in a straight line from one end of the bumper to the other. The bumper is now ready for the customer.

The illustration Fig. 9 shows the Bonderizing tanks in which the bumper arms are rust proofed before being enameled. The first tank in the illustration contains the Bonderizing solution and the second tank is the rinse tank. The arms are left in the Bonderizing solution the required number of minutes, sufficient to properly Bonderize the surface of the metal, then they are washed in the rinse tank for approximately 1 minute.

JELLIFF DIPPING BASKET FOLDER. A six page folder devoted to Dipping Baskets has been issued by the C. O. Jelliff Mfg. Corp., Southport, Conn. It explains the service rendered by this firm in supplying baskets to meet individual requirements when specifications preclude the use of any of their fourteen standard designs. The chemical action on several commonly used metals is given in tabular form. Copy free upon request.

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Uses and Advantages of Aluminum Paints

By Milton W. Lightcap

THE use of aluminum paint for a countless number of purposes is on the increase. Many claims are being made for its adaptability as a suitable primer for use over wood surfaces. In the metal field it is finding wide favor principally as a finishing coat material on metal products.

In the metal finishing field, aluminum paints are considered by some authorities to be suitable for only finish coat work due to the opinion that aluminum paint itself is not a rust inhibitive covering when applied over metal surfaces. Others disagree with this opinion, although the use of red oxide, red lead and other inhibitive paints for prime coat purposes is quite generally accepted.

Aluminum paint, contrary to some opinions, can be obtained in a number of qualities. For some purposes, only the more expensive high-grade types will suffice, while, where requirements are less exacting, some of the lower priced materials may be used with entire satisfaction.

This type of paint is composed of aluminum bronze powder or paste, the latter type showing a very rapidly increasing popularity. With this

Fig. 1—Aluminum Painting of Louvre Fencing for Water Cooling Towers

powder or paste is mixed a suitable vehicle composed of especially compounded ingredients. To obtain the best possible type of finish only the best grade of aluminum powder or paste should be used, as well as the proper vehicle.

To those who are not familiar with the so-called "leafing" properties of the pigment a brief description should be of interest. As the aluminum paint is brushed or sprayed on to the metal surface, the tiny metallic flakes swirl around in the vehicle. Some rise to the surface or "leaf" and others arrange themselves in parallel layers throughout the film. This therefore affords a durable and continuous coat of metal protection highly resistant to moisture, sulphur and acid-ladened atmosphere.

The reflectivity of aluminum paint is a characteristic which accounts for the wide usage of this type of finish on storage tanks and towers to reduce the inside temperature, also on bridges and elsewhere to improve visibility. This "leafing" makes possible the unusual hiding power of aluminum paints as well as their moisture-proofing efficiency. The finer in particle size the pigment is, the smoother and more brilliant the surface will be.

It is a quite generally accepted opinion that the longer the aluminum pigment is permitted to stand in the vehicle, the less brilliant will be the coat of paint when applied. Also the leafing qualities of the metallic flakes will be reduced considerably.

This being the case, unless aluminum paint is to be used immediately it has become the practice to purchase the product in double-compartment cans, one containing the powder or paste, the other the vehicle. Or, the powder or paste may be bought separately in any quantity and the vehicle can be purchased in gallons, fives or drums. In any event, the paint thus purchased retains its full brilliance and leafing properties and can be mixed as needed, taking care to never mix more than will be used in a day's time.

In order to obtain entirely satisfactory results, metal products which are to be used under varying conditions will not only require painting with a paint containing the proper amount of pigment but one also comprised of a suitable vehicle. Depending on the type of exposure which will be involved, the quantity of aluminum powder or paste mixed with the vehicle will range from 1½ lbs., where ordinary conditions prevail, to 1½ lbs. to each gallon of vehicle where unusual conditions exist.

As a vehicle, ordinary varnish will not meet the necessary requirements. In fact, no one vehicle can be made to mee tthe requirements of all surfaces under all conditions. It is therefore imperative to use a vehicle which is especially formulated for use to which the paint is to be put. So as to be on the safe side in using the proper vehicle it will be well to give consideration to only those meeting the specifications of the Aluminum Company of America. The use of only these vehicles will assure a product of proper consistency and flow, good brushing and spraying properties, proper drying and good adherence.

Conditions will be encountered where severe exposure and dirt collection, acids and fumes are prevalent; also where the metal surface will be subjected to varying degrees of heat. Through the careful selection of the right vehicle, successful finishing of the metal products can be accomplished.

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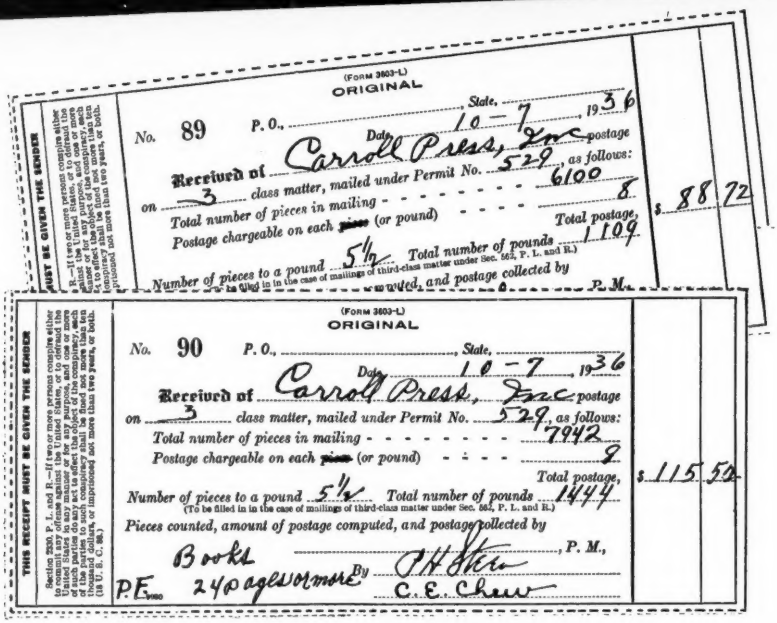

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OCTOBER, 1936, ISSUE OF PRODUCTS FINISHING

No. 89—1,109 Pounds (5½ Pieces Per Pound)	Total Pieces	6,100
No. 90—1,444 Pounds (5½ Pieces Per Pound)	Total Pieces	7,942
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	Total Distribution of October Issue . . .	**15,073**

UNCLE SAM'S RECEIPTS

"The Unalterable Proof of a Magazine's Circulation"

AS EVIDENCED by the figures at the left, the total distribution of the October issue of PRODUCTS FINISHING was 15,073 copies. The United States Post Office receipts, reproduced in facsimile at the left, show a total of 14,042 copies placed in the mail on October 7th. In addition, 611 copies were sent out with stamps affixed and 420 were distributed at the National Metal Show, October 19-23 in Cleveland.

Following is a circulation breakdown of the October issue by types of readers and industries:

Metal-Fabricating Plants (Pres., Vice Pres., Sec. and Treas., Gen. Mgrs., Engineers, Supts., and Foremen in Charge of Operations)	**9,334**
Plating, Buffing, and Polishing Companies	**1,191**
Foundries, Aluminum, Brass, Gray Iron, Malleable, and Steel	**2,784**
Schools and Colleges, operating large Vocational Departments	**301**
Platers' and Polishers' Supply Houses	**114**
Stamps Affixed, Miscellaneous	**611**
Distributed at National Metal Show	**420**
Advertisers, Prospective Advertisers, and Agencies	**318**
	15,073

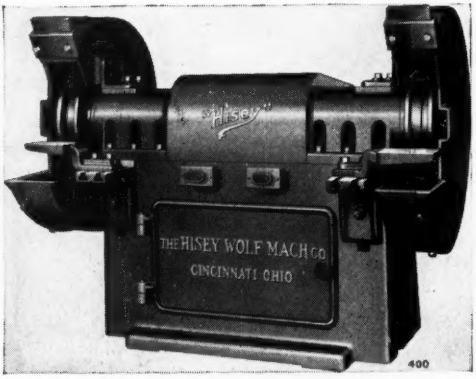
Additional information concerning advertising in this publication will be sent upon request.

PRODUCTS FINISHING
704 Race St., Cincinnati, Ohio

New Plant Equipment and Materials

Hisey-Wolf Heavy Duty Texdrive Snagging Grinder

The Hisey-Wolf Machine Co., 2745 Colerain Ave., Cincinnati, Ohio, has brought out a line of Heavy Duty Texdrive Snagging Grinders made in four sizes—5, 7½, 10 and 15 h.p.—and in 15 different types comprising single spindle grinders, multi-speed grinders, and two spindle grinders with one or more speeds. The machines are designed and proportioned throughout for the most severe duty, with weight scientifically distributed to minimize vibration. Wheel guards and mounting brackets are of steel as are also the hinged covers and chip breakers. Guards can be adjusted to the wear of the wheels. Work supports have horizontal and vertical adjustments and are extra heavy.



Hisey-Wolf Heavy Duty Texdrive Snagging Grinder

The two motor, two spindle grinder is most efficient in that the speed of either spindle can be changed independently according to the size of the wheel. On single spindle machines with multi speed drive, the size of the larger wheel naturally determines the operating speed for reasons of safety. All multi-speed machines are equipped with safety devices so that the wheels must operate at the proper speeds. Speeds are changed by shifting the belts from one set of sheaves to another.

The Hisey system of wheel transfer is used, which employs groups of single speed grinders arranged in sets for different size wheels. Thus when the new wheels on one machine are worn down to a certain smaller size, they are transferred to another machine which has guards and is speeded according to the smaller diameters of the wheels. When these wheels are worn down to a still smaller size, they are again transferred to a third machine which operates at the higher speeds required for the smaller wheels. Thus all wheels throughout their entire life have operated at their most efficient and economical speeds. The wheel flanges are accurately machined all over and are carefully balanced. Wheels are clamped close to the hole by means of six hardened socket head cap screws. The entire assembly of wheel and flanges can be removed for transfer as an integral unit.

The motor is solidly mounted at four points with provision for belt adjustment. Although regularly supplied with motor, the grinders can be furnished without motor and with base for accommodating any size and type of motor. Spindle speeds can always be furnished to suit, regardless of motor characteristics.

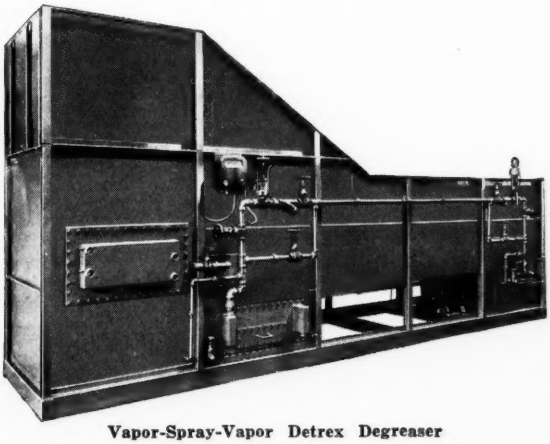
Vapor-Spray-Vapor Detrex Degreaser

The line of degreasers manufactured by Detroit Rex Products Company, 13017 Hillview Ave., Detroit, Mich., has been augmented by a Vapor-Spray-Vapor machine equipped with a monorail conveyor. The unit has been designed to handle small racked parts such as poppet valves, flat sheets, and so on.

The conveyor is so arranged that the work is lowered into the solvent vapors and passes through pressure sprays of hot clean solvent. After making a horizontal turn around a traction wheel, the conveyor brings the work back again through solvent vapors. Continuing on, the work is elevated and passes out of

the machine at the same end and at the same elevation as it went in.

Steam coils are positioned in a boiling sump, which can be seen in the lower left center of the accompanying illustration, and in a clean solvent distillate collecting chamber, shown at the right end of the machine. This machine is



Vapor-Spray-Vapor Detrex Degreaser

equipped with an air-actuated, steam-operated, thermostatic control. The boiling sump is equipped with an auxiliary clean-out door to obviate the necessity of removing the steam coils when cleaning out accumulated sludge.

A tube-type condenser augments the supply of clean solvent distillate provided by the water jacket condenser. A solvent collecting trough is located beneath the water jacket condenser. All of the distillate flows into a heating chamber at the right end of the degreaser. From here, it is force-pumped directly on to the work. The solvent that drains from the work, as well as the overflow from the clean solvent heating compartment, flows back into the boiling sump.

To insure maximum heating economy, this machine is insulated with panelled mineral wool up to the water jacket condenser. The rated production cleaning capacity of this machine is said to be approximately 6500 small parts per hour at a conveyor speed of 10½ ft. per minute. The overall dimensions of the unit are 20 ft. long, 5 ft. wide, and 9 ft. high.

Sterling "Floating Block" Electric Sander

An electric sanding and rubbing machine designed to operate with a reciprocating action has been brought out by Sterling Products Company, 314 Curtis Bldg., Detroit, Mich. The machine is driven by electric motor through a flexible shaft. The sanding action is reciprocal with ⅝ in. travel of the sanding pad at speeds from 1750 to 2800 complete oscillations per minute, depending upon the type of work upon which it is to be used. This movement is intended to duplicate the natural back-and-forth motion of hand sanding and rubbing.

The principle of "floating" as applied to the construction of the block is an exclusive patented feature. Flexible rollers of special composition rubber and fabric are attached floatingly by pins to the sander block and special pads of varying flexibilities are available. The construction of the machine is such that

Production Increased — Hour Cost Reduced

Send a few of your parts and a sample of the finish desired.

Estimate of production on Packers gladly sent without obligation.

PACKER *Automatic*

POLISHING AND BUFFING MACHINES

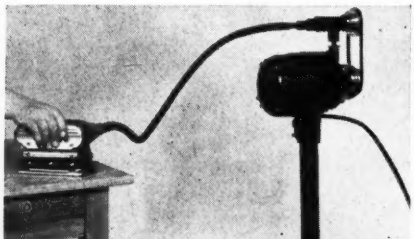
THE PACKER MACHINE CO. **MERIDEN, CONN.**

there is no restriction in the movement of the block. The machine is applicable to curved and flat surfaces of metal fabric, wood, composition, leather and marble, and for such delicate operations as the finishing of stringed musical instruments, buffing of leather, as well as the heavier production requirements of finishing machinery, auto bodies, and railway cars.

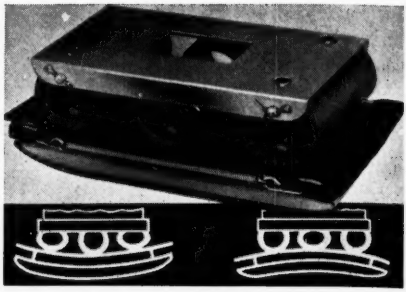
The machine is designed for wet or dry sanding and finishing. For wet operation, a water connection is provided with a series of openings on each side of the block, providing a spray that is readily adjustable to the requirements of the job. For gas sanding with naphtha, gasoline and benzine, a special block with Sterlite base is provided. From one to five sheets of abrasive may be attached to the pad at one loading, ordinary size sheets being cut in three pieces without waste.

The machine is portable and may be operated from any electric outlet, either 110 volt or 220 volt. Three different types of mountings are provided; the bench plate type with motor mounted on a metal plate for use on the work bench, the ceiling suspended type with the motor suspended from the ceiling or an overhead monorail by means of bail-type handles, and the bench height pedestal model with a three-leg caster base.

Perfect balance of the sander head and the light weight of 7½ lbs. plus the compact dimensions of 7 in. long by 4¾ in. high and 3¾ in. wide are said to make the machine extremely responsive to the guidance of the operator in any position and provide a comfortable fit to the palm of the hand.



Sterling Bench Height Pedestal Model Electric Sanding Machine



View of Sterling Sander Head showing the Floating Block".

Milburn Type MM Paint Spray Gun

A Type MM Paint Spray Gun which is said to incorporate many features and advantages has been announced by the Paint Spray Equipment Division of The Alexander Milburn Co., 1424 W. Baltimore St., Baltimore, Md. The Type MM Spray Gun is evenly balanced and is said to shoot a smooth, even spray. The coverage and shape is controlled by merely turning two simple knurled nuts. The gun, which is precision built, is said to operate with a minimum of effort.

Cleaning is only the matter of a few seconds as every part touched by the paint is in the single unit detachable spray head. This spray head is of drop forged bronze of unusual durability, machined with rifle-like precision and alignment. The entire unit has a low center of gravity, which makes for perfect balance. The gun handles are of one-piece, light-weight die cast aluminum alloy. The atomizer head is of one piece, precision machined and concentrically centered on the fluid nozzle, assuring accurate alignment. Direct and commodious air passages provide an abundant, free-flowing air supply. A two-finger grip trigger conforms naturally to the shape of the fingers responding to the slightest touch. The trigger works against a non-corrosive ball bearing in the end of the air valve stem thus assuring frictionless operation.

The fluid nozzle is made of wear-resisting steel with internal and external tapered seats, hardened and burnished to the most exacting specifications. A

knurled adjusting nut operates a non-corrosive needle valve for regulating air flow to the atomizer head and for controlling the spray volume and the shape of the spray. Another knurled nut ad-

Milburn Type MM Paint Spray Gun

justs fluid flow by means of stainless steel needle valve, which is connected by a universal joint for constant alignment and easy, economical replacement of paint needle valve points. The valve is closed by a tension spring which assures perfect seating under high fluid pressures.

Fluid and air control valves are set so that when the trigger is pulled, air is first admitted into the spray head, then the fluid; when trigger is released the fluid needle valve closes first, then the air valve. This action prevents weeping or spattering when the fluid is turned on. The fluid connection is conveniently located beneath and is a part of the detachable spray head, permitting instantaneous connection of fluid hose or siphon container.

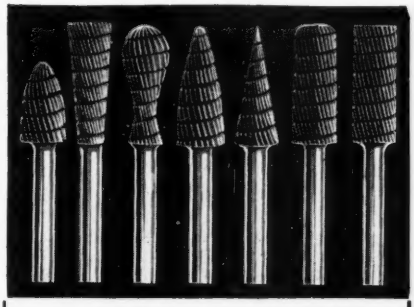
The Milburn type MM Spray Gun is satisfactory for almost any painting operation, regardless of size and whether siphon or force feed. It utilizes all types of spraying materials including synthetics and emulsions. It is particularly recommended for spray work where wide, perfectly atomized spray is required. It is recommended for such work as automobiles, furniture, machinery, metal parts, structures, or wherever a spray gun of unusual capacity and adaptability is specified.

Model G Hypressure Jenny

The Homestead Valve Manufacturing Company, Coraopolis, Pa., which for several years has been manufacturing high pressure valve spray cleaning equipment under the trade name of Hypressure Jenny, has added to their line a unit to be known as Model G. With the Model G, cleaning is accomplished by means of applying a combination of water vapor, hot water and cleaning chemicals, through a nozzle to the surface to be cleaned over a pressure range of from 50 to 150 lbs. per square inch.

The unit is fully contained, comprising water, solution, and oil tanks, oil burner, vapor generator, water and solution pump, water jenny, electric motor, and especially constructed vapor hose with a variety of shaped nozzles. Vapor pressure is developed by means of a vertical-spiral-parallel-coil type vapor generator, and is controlled by an automatic pressure control switch. The vaporizing oil burning system burns standard kerosene or light furnace oil.

Both temperature and pressure are held within narrow limits of variation. A safety valve and full nozzle control are said to give the operator absolute control of the spray and eliminate the danger of damage to the generator or



McNEIL MILL CUT ROTARY FILES

. . . for cleaning cored holes and recesses preparatory to buffing and polishing.

. . . for burring of finished machine parts.

. . . for cleaning of excess beads and flash in machine welded parts.

Made in fine, medium, and coarse cuts.

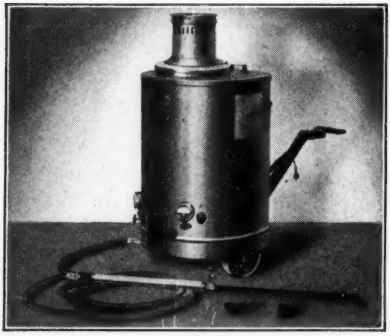
Write for circular and prices.

McNEIL BROS. CO.

Box 33, College Hill, Cincinnati, Ohio

operator. A saturation selector enables the operator to change the spray and obtain a wetter or dryer vapor as needed to obtain the proper spraying effect. Paint may be stripped in this manner by using very hot water containing a strong alkali; or by adjusting the spray and pressure, tar or very heavy grease may be blasted off.

Efficiency of the unit has been further increased by the development and use of



Model G Hypressure Jenny

a single triplex plunger pump equipped with mechanically-operated inlet check valves. The pump is so designed that without interruption it handles water, liquids containing chemicals, sticky fluids, gasoline, and oils. In these cases, it pumps both the oil to the burner and water to the coils. Model G Jenny is made in both stationary and portable types. The stationary unit is mounted on a platform with legs which raises it several inches above the floor. The portable unit is mounted on a truck with 10-in. diameter semi-steel roller bearing wheels, 2½ in. wide. Solid rubber tired wheels are also provided where needed. No boiler inspection or licensed operator is required in order to operate the Model G Jenny.

Metalprep

A liquid cleaner which removes rust, dissolves hardened film, prepares metal for paint, insures a bond between metal and prime, to be known as "Metalprep" has been announced by the Neilson Chemical Co., 6564 Benson St., Detroit, Michigan.

Metalprep is a phosphoric acid base metal cleaner which is prepared and shipped in a concentrated liquid form in lead lined drums and glass carboys. In use, the concentrated Metalprep is diluted with two to three parts water, depending upon the kind and condition of the metal in process.

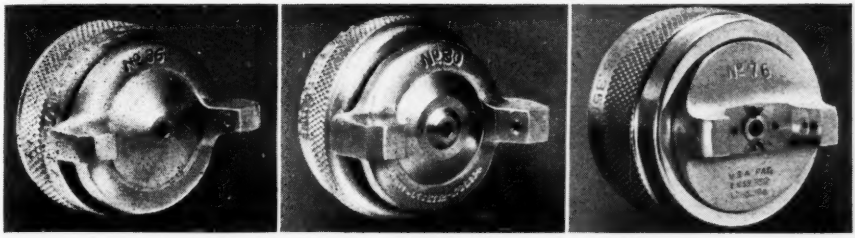
Oil, grease, wax, rolling compounds, and other foreign matter on the surface of the metal can be removed with Metalprep in such a manner as to leave the surface chemically clean and ready for paint. Rust is removed rapidly and completely. This liquid cleaner is non-inflammable. It is not injurious to the health and has no toxic effect. Metalprep, lending itself to a "wipe-up" process, permits far greater flexibility than is the case where hot water "wash off" must be used.

DeVilbiss Spray Gun and Air Caps

To meet the conditions that have been set up by the development of synthetic finishes, the DeVilbiss Company, 300 Phillips Ave., Toledo, Ohio, has brought out a spray gun which, with proper nozzle combinations, may be used to spray any sprayable material. Large air passages in this spray gun permit a greater volume of air to be brought up to the spray head, or working end of the gun; thus there is less air pressure through the gun, and the proportion of air to material flow is increased.

The spray head has large port openings and a baffle arrangement which insures uniform distribution of air to the horns and center orifice of the air cap. This design results in uniform atomization of material and a balanced, uniform spray pattern. New style air caps which can be provided for this type of spray gun have four or more air ports for synthetics, while the style used for lacquer has two air ports. Spray heads are supplied by the DeVilbiss Company with the particular air cap and nozzle combination recommended for the kind of work being done, for the particular material feed in use, and the speed of production required.

Improved multiple-jet air caps of the DeVilbiss make are said to produce the maximum atomization and spray patterns, and uniform application of material. They provide increased air volume, prevent split sprays at high pressures, and produce an even application instead of a heavy center type of pattern. The small nozzle size and consequent reduction of material flow saves material, provides greater air volume in proportion to material flow, and pre-



DeVilbiss Air Caps. (Left) No. 36. (Center) No. 30. (Right) No. 76.

vents sags and runs.

The compressing unit should be of sufficient size, in cubic feet of air per minute, to keep the spray gun in continuous operation at the desired pressure. Maximum efficiency, speed and quality of finish cannot be expected of any spray gun unless the air compressing equipment constantly delivers the volume of air consumed by the air cap. The diameter and length of the air hose used has a marked effect upon the efficient performance of a spray gun and the quality of finish it produces.

Shown in the illustration are three types of air caps made by the DeVilbiss Company. The No. 36 type, at the left in the illustration, can be used for the suction feed application of lacquer and similar materials. Under certain conditions it is also suitable for use with gravity or pressure feed. It is designed for use with atomizing air pressure not exceeding 69 lbs., and has two air ports, one in each horn.

The No. 30 cap, shown in the center of the illustration, is designed for suction or gravity feed application of synthetic materials and lacquers, and is intended for use with an atomizing air pressure of 50 lbs. or more. In addition to the air port in each horn, it has two small auxiliary ports or jets close to the center orifice. In the application of light-bodied materials, it produces a soft spray without splitting with sufficiently tapered ends on the pattern for easy lapping. It also produces finishes with heavy-bodied materials where atomization is difficult.

The No. 76 pressure feed multiple jet air cap, shown at the right of the illustration, is intended for higher production use with heavy-bodied lacquers, primers, and synthetics. In addition to two ports in each horn, it has four auxiliary atomizing jets near the center orifice. While it will handle the ordinary light-bodied materials, it is not recommended for them. It is said to be very fast and to be able to deliver a considerable amount of material.

Oliver Variety Belt Grinder and Polisher

The illustration shows a flexible and adaptable bell surfacer and polisher for both metal and wood working which has been placed on the market by Oliver Machinery Company, Grand Rapids, Mich. The machine is designed for rapid belt grinding and polishing of all kinds of small and medium-sized metal pieces of convex, concave or irregular shapes, edge work, and flat surfaces, and has proved highly efficient on ornamental metal work, compositions, and wood.

An outstanding feature of the machine is the fact that it can be used in either vertical or horizontal position. As shown, the machine is set for use in the vertical position, but it can easily be swung to any angle in an inclined position. The backing place can be moved in or out, the table can be tilted up or down, and the arm or post together with the idler pulleys and the table may be inclined to the right or left.

The main drive pulley is mounted on a countershaft located in a substantial base. A support arm carries two clamp brackets, one of which supports the

NEW SPRAY GUN

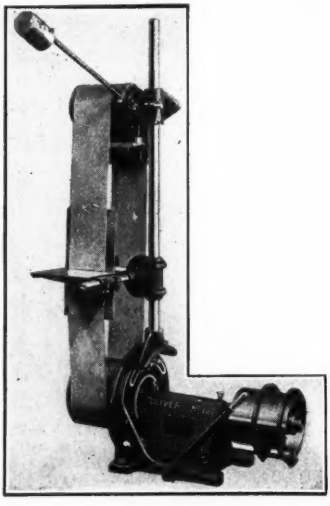
In the time it takes to adjust old fashioned paint spray equipment, you can write us for specifications and prices of the new Type MM Paint and Lacquer Spray Gun, which cuts both time and operating costs on every job and builds your profits. Bring your shop up-to-date with the new Type MM Spray Gun.

THE ALEXANDER MILBURN CO.
1436 W. Baltimore St., Baltimore, Md.

main idler pulley and the tension idler while the other supports the table and backing plate or any forms or flexible pads which may be required. The machine will take belts up to 10 in. wide and 14 ft. long.

The edging table, which is 10x12 in., is of cast iron. The table tilts to any angle up to 30 deg. either up or down, and can be adjusted in or out. Drilled holes provide for attaching wood tops or forms. The backing plate is 10 in. wide and can be adjusted in and out to provide suitable tension on the belt. The main idler runs in ball bearings and is adjustable up or down the whole length to take care of various lengths of belts. This pulley is faced with rubber. The tension idler, which is also rubber faced, is of the ball bearing type and fulcrums in the center line of the main idler, weights being provided to give the right tension to the belt.

A fork idler can be mounted on the machine in place of the regular table for grinding and polishing oval frames and other irregular shapes. The fork idler is rigid in construction and carries two aluminum idlers which run in ball bearings and are adjustable to the work. The countershaft is 1½ in. in diameter and runs in roller bearings.

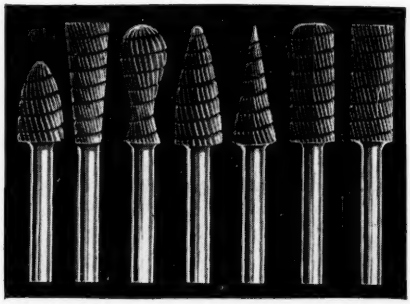


Oliver Variety Belt Grinder and Polisher

The driving pulley is 14x10 in. and is rubber faced. The tight and loose pulleys are 10 in. in diameter with 5-in. face. Speed is 900 r.p.m. Height overall, 80 in.; floor space required, 4x8 ft. For motor drive a 2 h.p. totally enclosed fan cooled motor of approximately 900 r.p.m., is direct connected to the lower drive pulley.

McNeil Mill-Cut Rotary Files

Mill cut rotary files are now being manufactured and marketed by McNeil Bros. Co., Box 33, College Hill, Cincinnati, Ohio. The files which are made in a wide variety of shapes, are adaptable to many finishing jobs. Among the uses for these files are the cleaning of cored holes and recesses preparatory to buffing and polishing, burring of finished machined parts, and cleaning of excess beads and flash in machine welded parts especially in places that are inaccessible by any other method. The files are produced in fine, medium and coarse cuts. Literature is obtainable by writing the manufacturer.



McNeil Mill-Cut Rotary Files

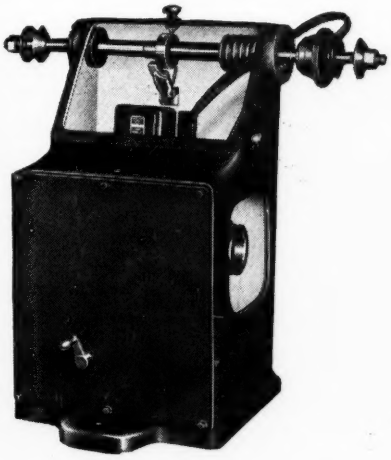
Marschke Selective Speed Buffer

The illustration shows a rear view of a partly disassembled Marschke Selective Speed Buffer which is now being marketed by the Vonnegut Moulder Corporation, 1815 Madison Avenue, Indianapolis, Indiana. The spindle is driven by two strands of V-belt from a standard industrial type motor, adjustably suspended in the base, which may be fitted with a pulley diameter to obtain a single spindle speed as specified from 2000 to 3000 revolutions per minute.

The motor may also be fitted with a three-step pulley and a six-groove spindle, thereby changing the specifications to a variable speed machine which is

illustrated as type FBCV.

The illustration shows the rear upper base cover plate and one of the ball bearing housings removed to explain the



Marschke Selective Speed Buffer

method of replacing belts. The base is a one-piece casting with three points floor contact.

The motor is controlled by a push button mounted in the front of the base and a magnetic contactor with overload and undervoltage protection mounted within the base.

The spindle is of heat treated steel alloy mounted in double row deep groove, combination radial and thrust type ball bearings. It can be brought to an abrupt stop by means of a hand lever projecting through the front face of the base and locked by means of the knob and pin at the top center of the machine.

The buffer is available with a 3 h.p. or a 5 h.p. motor, weight 900 pounds. Two features of this machine are selectivity of spindle speed to meet the requirements of any buffing or polishing problem and pleasing design.

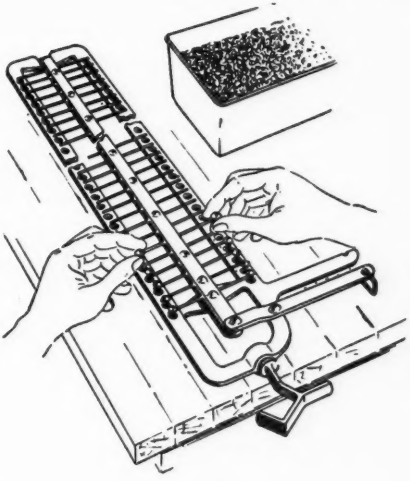
Quik-Rak

The Rack Division of The Kelly Plating Co., 10316 Madison Avenue, Cleveland, Ohio, has brought out a plating rack to be known as "Quik-Rak."

Two types of the Quik-Rak are obtainable. Type 1 is for use in Chromium plating screws, bolts, rivets, or other similar parts. Type 2 is for use in nickel plating, screws, bolts, etc. The racks can be rapidly loaded by inserting parts to be plated in holes large enough to accommodate the pieces without sticking. The pieces are then locked in the rack by a simple clamper instrument which holds them tightly until the plating cycle is completed. All pieces are instantly unloaded by releasing the clamp, allowing them to fall from the rack by gravity. The spine of the rack is of steel and has no electrical conduction function. It cannot be harmed by contact with the Chromium plating solution. The bronze frame is rugged and quite simple to insulate against any action in the bath.

It is advisable for best results in plating and to insure long life of the rack to cover it with any good rack enamel, leaving only the inside of the holes bare to make contact with the screws or bolts. A suitable rack enamel dipped or sprayed on the rack will insulate it for four or five days of steady production.

With the Type 2 Quik-Rak for nickel plating, the thread of the article being plated is shielded during the plating process. The shielding is so effective that it is possible to deposit several thousandths of metal on the head of the bolt and still permit the gauge to



Kelly "Quik-Rak"

pass over the thread. The Type 2 is sturdily constructed with all parts pro-

tected by a thick covering of rubber. No metal is deposited on the rack during the plating cycle. The only part exposed is the inside of the hole where contact is made with the part being plated.

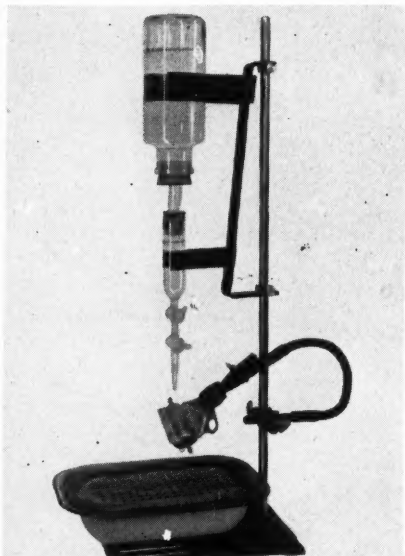
Chemicrometer

An instrument for measuring cadmium and zinc deposits to be known as the "Chemicrometer" has been brought out by the Plating Products Company, 352 Mulberry St., Newark, New Jersey.

The instrument as shown in the illustration consists of a reservoir bottle with one pint of test solution, (for cadmium or zinc), connecting tubing and stoppers, special stop-cock dropping funnel, supporting stand and bracket, pan, and either perforated celluloid grid or flexible clamp.

The type of test in which this instrument is used is known as the "dropping" method. For carmium deposits an ammonium nitrate-acid mixture is used, one drop at a time. It has been determined that when such a mixture is dropped on the article under test at 80-120 drops per minute, the deposit is dissolved at the rate of .0001 in. every 10 seconds. Thus a deposit that will stand up for 25 seconds before exposing the base metal has a thickness of 0.00025 in.

A mixture of ammonium nitrate-nitric acid will dissolve zinc deposits at the same rate—that of 0.0001 in. in 10 seconds.



Chemicrometer

Black & Decker No. 35 Heavy Duty Sander

A heavy duty sander for use in sheet metal, foundry, body, cabinet, and assembly plants, to be known as the No. 35 has been announced by the Black & Decker Mfg. Co., 720 Pennsylvania Ave., Towson, Maryland.

Black & Decker No. 35 Heavy Duty Sander

The No. 35 has a dust-sealed commutator and switch completely protected from abrasive dust and dirt. A plunger-type switch greatly improves control and increases safety of operation. Straight-line ventilation through ample air-slots prevents clogging and assures cool motor operation. Reversible side handle can be used on either side of tool to suit operator. The universal motor with which the unit is equipped operates on A. C. or D. C.

The No. 35 can be used in production service in all types of metal finishing including sanding of automobile bodies, fenders, furniture, cabinets, tanks, frames, etc. A felt rubbing pad is supplied for rubbing down lacquer and removing orange peel. A cup wheel is supplied for surfacing stone and tile, or smoothing welds and casting ridges. A wire cup brush is also supplied for removing scale, rust, and old paint.

Net weight of the unit is 12½ lbs. No-load speed is 4200 r. p. m. Standard equipment includes a 3-conductor cable and plug, a 7 in. flexible felt and metal pad, detachable side handle, three 7 in. sanding discs (1 coarse, 1 medium, 1 fine).

Orthosil

An alkaline detergent to be known as Orthosil, for use in heavy duty cleaning operations, has been placed on the mar-

ket by the Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa. Orthosil is an anhydrous sodium orthosilicate long sought by chemical manufacturers.

Orthosil solutions are said to be remarkably efficient in cleaning ferrous metals preparatory to painting, plating, and vitreous enameling. Hot solutions of Orthosil will remove all types of soil usually found on steel, except that removed by pickling. Metals cleaned with these solutions have a characteristic bright appearance.

Orthosil solutions have a very high dissolving power on grease and dirt, and remain efficient for a long period of time without need of replenishing. They have the ability to hold soluble dirt and grease in suspension after removing them from the metal, and to prevent this soil from being redeposited on the clean material. The manufacturers state that not only are time and labor costs reduced, but that Orthosil itself is inexpensive due to the fact that only a small amount of it is required to do the work. It is a concentrated alkaline detergent which is unhampered by inert salts or relatively weak alkaline diluents.

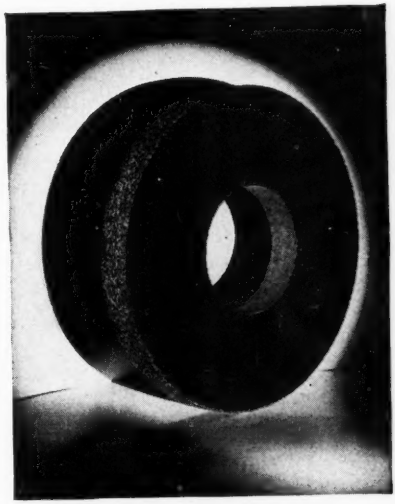
The action of Orthosil is enhanced by mechanical scrubbing, by agitation, or by "gassing" (that is, the generation of hydrogen or oxygen on the surface of the article being cleaned by passing electric current between the metal and the cleaning tank via the Orthosil solution). In this latter method Orthosil is particularly efficient because its solutions are excellent conductors of electricity. Gas is generated uniformly and copiously on the light surface of the metal. This gas lifts the grease and dirt from the metal and assists the Orthosil solution in its work of setting the surface. The dirt is removed from the metal, which is left clean and ready for further processing.

Because of its high strength the new detergent is not recommended for cleaning applications in which its solutions are in continued contact with tin or aluminum.

Orthosil is shipped in large drums in the form of dry, white, free-flowing granules readily and completely soluble in hot or cold water.

Manhattan Finishing Wheel

The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, New Jersey, has developed the "Manhattan" finishing wheel to extend the range of application of rubber bonded wheels. Grinding wheels bonded with hard rubber give exceptionally good results, es-



Manhattan Finishing Wheel

. . . for coating any flat surfaced material, whether in form of a heavy, stiff board or a light, flexible sheet for high grade work

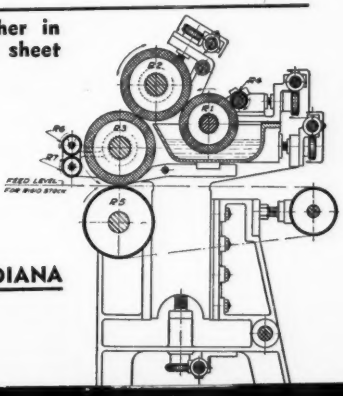
The New Francis Model T-R

COATING MACHINE

This machine is fitted with Metal, Rubber, Composition, or whatever kind of Rolls are required, and provision is made for quick change from one kind of Roll to another. It will spread, uniformly—varnish, paint, adhesive, etc., on metal, wood, paper, leather, cloth, and other materials. Largest and Most Complete Line of Coaters, Spreaders, Mixers, etc.

SEND SAMPLES OF YOUR WORK.

CHAS. E. FRANCIS CO. RUSHVILLE, INDIANA



pecially where ultimate finish is a factor.

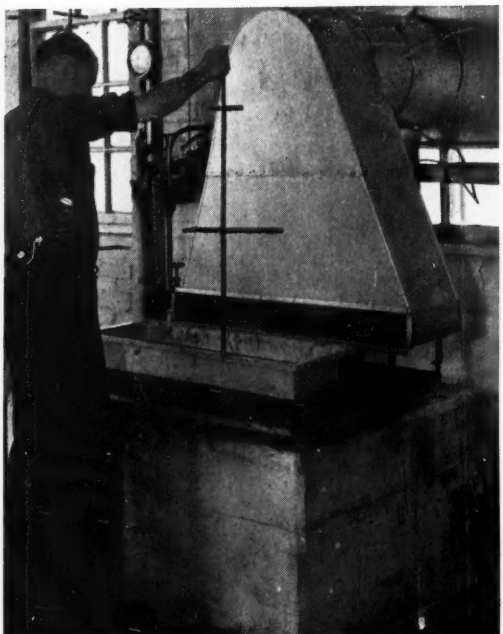
The Manhattan finishing wheel is a fine grit wheel with a slight "cushion" effect, to follow up grinding operations. It has a very good combination of clean cutting action and good finish. This wheel is adaptable for finishing work such as welds on stainless steel equipment, stainless steel forgings for aircraft, taps and twist drills in both carbon and high-speed steels. Since the wheel is slightly flexible and has some "give" it can be used on work having relatively curved surfaces.

Miller Korolac Dipping Tanks

A rubber-like material for insulating plating racks to be known as "Korolac" for use in a Miller Korolac Dipping Tank has been brought out by the J. C. Miller Co., 528 Lake Michigan Drive, N. W., Grand Rapids, Michigan.

Korolac is suitable for use in chrome, nickel, cadmium, zinc, copper, brass, silver, gold and tin plating baths. It is not materially affected by alkali cleaners and acid dips. It stops the waste of metal deposited on racks and increases the amount of metal deposited on the work.

The Miller Korolac dipping tank in which plating racks are dipped to be insulated with Korolac is furnished with either steam coils or electrical heating units and temperature regulators fitted with ventilating hood.



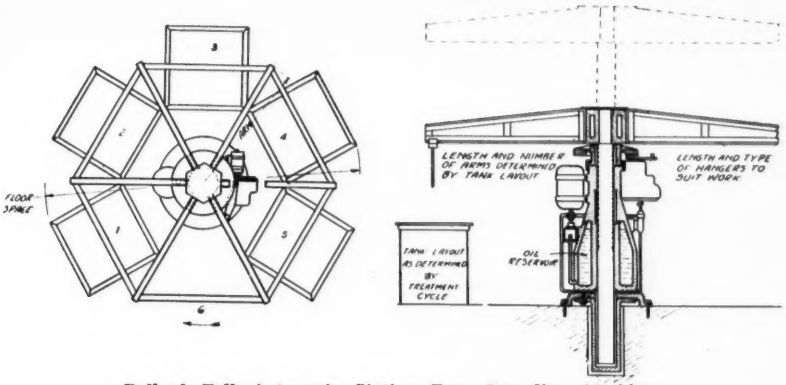
Miller Korolac Dipping Tanks

Bullard Full Automatic Station Type Descaling Machine

The Bullard-Dunn Electro-Chemical Process for degreasing and descaling metals comprises an electrified treatment for the removal of grease and dirt, followed by a second electrified treatment in which the scale is removed without the slightest pitting, etching, or other damage to the work itself.

To carry out this process automatically at a uniform rate of production and to eliminate the labor of putting the work into and taking it out of the treatment tanks, the machine shown in the illustration has been developed by The Bullard Company, Bridgeport, Conn. The machine consists of a central column carrying radial arms from it, and on each of these arms racks, hooks or steel wire baskets required to hold the work in process are suspended. The treatment tanks are set around the column concentrically. The machine is controlled automatically by means of an adjustable electrical time switch or it can be made to function at the will of the operator by push button control.

In action, work is placed on the machine at the loading and unloading station. The column then raises, indexes, and lowers so that the work first placed on the machine is advanced to the second treatment tank, while the second load placed on the machine is simultaneously placed in the first treatment tank. This sequence continues until all of the arms have been loaded, after which the work first placed on the machine, having completed the treatment cycle, is delivered at the unloading station where it


FLOOR SPACE
LENGTH AND NUMBER OF ARMS DETERMINED BY TANK LAYOUT
LENGTH AND TYPE OF HANGERS TO SUIT WORK
TANK LAYOUT AS DETERMINED BY TREATMENT CYCLE
OIL RESERVOIR

Bullard Full Automatic Station Type Descaling Machine

is removed from the machine and replaced with a load of uncleaned work.

The machine is simple, rugged, has high load capacity, and eliminates the use of moving chains and of sliding electrical contacts.

Tegul-Vitrobond

A newly developed acid-proof cement to be known as "Tegul-Vitrobond" has been brought out by the Atlas Mineral Products Co., Mertztown, Pa. This cement is said to be an improved acid-proof sulphur cement with a maximum resistance to thermal and mechanical shocks, for use in acid-proof masonry construction.

Reinforced concrete shells can be made acid-proof with a lining of acid-proof masonry joined with Tegul-Vitrobond. Tanks can also be built using acid-proof brick only and joined with this sulphur cement. Tegul-Vitrobond is inert to hydrochloric, sulphuric, acetic, lactic and phosphoric acids. It is inert to nitric acid up to 30 per cent concentration and resistant to salts such as sodium chloride, ferric chloride, ammonium chloride, ammonium sulphate, copper sulphate, ferrous sulphate, ammonium nitrate, etc. Having a tensile strength of 600 lbs. per sq. in. and compressive strength of 6000 lbs. per sq. in., it compares favorably with the physical properties of acid-proof brick. Tegul-Vitrobond is easy to apply and is ready for service immediately after it has solidified in the joints, which takes but a few minutes. Since all of its ingredients are inert to acids definite temperature conditions or acid treatments are not required to cause it to set or harden.

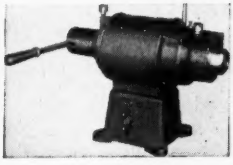
Haveg Construction Material

A construction material that has been finding considerable use in the metal industry is being manufactured under the name of "Haveg" by the Haveg Corporation, Newark, Delaware.

Haveg is a moulded composition based on a phenol formaldehyde resin and a special acid washed asbestos. Its composition makes it extremely resistant to most acids except strongly oxidizing acids like chromic and nitric. It is not resistant to the strong bases like sodium hydroxide.

Haveg is produced in the form of cylindrical or rectangular tanks, pipes and fittings, valves, and many similar items of equipment. It can be used to a considerable extent in the chemical industry because of the rugged leak proof and corrosion resistant properties of the material. In the metal field it can be used in the fabrication of pickling tanks, tanks for electrolytic processes, drain

IDEAL SPEED LATHES



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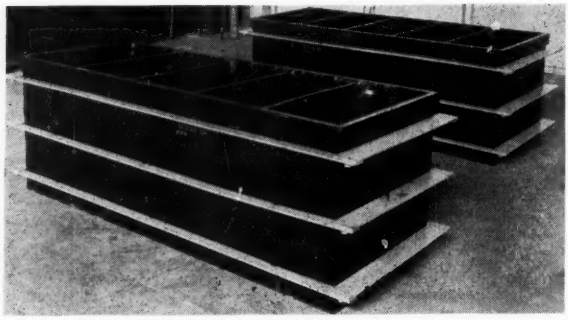


Electrolytic Tanks Made of Haveg

lines, and similar items. The fact that Haveg is unaffected by the usual pickling acids like dilute sulphuric and muriatic acid, even at boiling temperatures, has made it an extremely effective material for these purposes.

Similarly, in the electrolytic field numerous applications have been made, all of which have proved eminently satisfactory. Haveg cannot, however, be recommended for such installations as would include the use of sodium hydroxide or chromic acid.

Flexement

A flexible polishing wheel set-up medium to be known as "Flexement" has been placed on the market by the J. J. Siefen Company, 1936 West Lafayette Blvd., Detroit, Michigan. The manufacturer states that this cement is excellent for setting up discs and polishing belts as well as wheels. It can be used with any abrasive grain or emery size, from No. 30 to flour size. No glue pot is required or heating of grain as it works at all temperatures.

Flexement can be used just as it comes, without heating or thinning. It is very fast drying, which reduces the number of wheels required on any polishing job. Metal surfaces may be polished without burning the wheel or discoloring the work. A wheel, disc, or belt set up with Flexement will make maximum cuts without clogging.

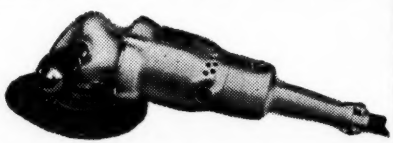
Albachrome Process

A new chromium plating process has been developed by the Albachrome Corporation, 40-35 Twenty-first Street, Long Island City, N. Y. This solution called "Albachrome," is said to be non-infringing and different in principle from existing methods. It is claimed that no control of any acid radical or addition agent is involved and that nothing has to be added to the bath but chromic acid. The process, it is stated, uses an unstable compound as an addition agent, and the chemical action ensuing does the work. The solution is said to last a long time, probably to a point where accumulated impurities make it desirable to overhaul the bath; said overhaul taking only about an hour or two. The baths call for analysis at regular intervals only for chromic acid and impurities.

The deposit is said to be bright, whitish, pliant, and closely adherent with very high throwing power obtainable when required, and to operate within the usual range of current densities.

Black & Decker No. 17 Junior Sander

The Black & Decker Mfg. Co., 720 Pennsylvania Ave., Towson, Maryland, have brought out a junior sander to be known as No. 17. The No. 17 is a light weight unit for intermitten service in shops. It is a compact tool, with re-



Black & Decker No. 17 Junior Sander

duced housing diameters and smooth surfaces, with good balance and very little weight. A thumb-operated tumbler switch insures safe control in handling. The unit incorporates straight-line ventilation through ample air slots, it prevents clogging and insures cool motor operation. A flexible pad adapts the sander to flat or curved surfaces. Abrasive discs are fastened to the pad by a flange nut. The unit is equipped with a universal motor which operates on either

an alternating or direct current. The no-load speed is 3200 r. p. m. Net weight of the junior sander is 7¾ lbs. Standard equipment includes a 3-conductor cable with plug, detachable side handle, 7 in. moulded rubber pad, three 7 in. sanding discs (1 coarse, 1 medium, 1 fine).

Special Metal Finish

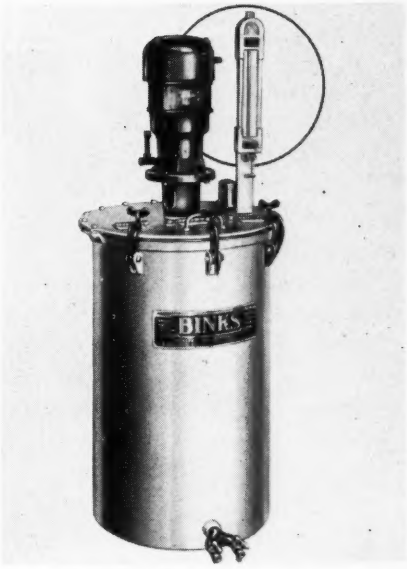
A new type of metal finish for machinery and industrial applications is being manufactured by the Asphalt Products, Co., Inc., Eastwood Station, Syracuse, N. Y. This finish, with an asphalt base, cannot be correctly called paint, lacquer, varnish or enamel, but, it is claimed to combine the good features of all four. It has a wide color range including gray, brown, green and red, as well as black.

It is said to produce a hard surface with an attractive lustre combined with sufficient resiliency to prevent cracking, checking or peeling. It is insoluble in oils and distillates of petroleum.

The finish is said to be strongly resistant to the action of alkali and most acids, chemical fumes, moisture, smoke, etc., and will stand temperatures up to 400 degrees F. without deterioration.

Binks Hydrostatic Gage for Paint Mixing Tanks

A hydrostatic gage for paint mixing tanks has been placed on the market by the Binks Manufacturing Company, 3114 Carroll Ave., Chicago, Ill. Assurance of absolute uniformity and viscosity of paint is obtained by "weight" mixing. A clear vision gage shows exact weight of lacquer and thinner added to the tanks. In this way any desired viscosity can be matched time after time.



Binks Hydrostatic Gage for Paint Mixing Tanks

The gage also serves as a "level indicator", and besides the weight calibration, it is also possible to read at a glance the number of gallons of liquid still in the tank. The Binks gage is said to be simple, accurate, and dependable. Hydrostatic in principle, it balances the weight of the liquid being measured against a known weight of the liquid in the U-tube. Connection to the tank is by means of a flexible copper tube encased in BX conduit. Binks Hydrostatic Gages are calibrated for use only with the Binks mixing and pressure tanks.

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